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ABSTRACT

This teaching packet is designed to teach Alaskan students in grades 4-6 about Alaska's seabird populations, the worldwide significance of seabirds, and the environmental conditions to which seabirds are sensitive. The packet includes a curriculum guide (containing a teacher's background story and 12 teaching activities), a separately published "Guide to Alaskan seabirds," an issue of a guide to Alaskan seabirds, Zoobooks seabirds magazine, and a full color poster promoting the protection of seabirds. The magazine issue and the poster are not included with ERIC's copy. Topics covered include seabird identification, food webs, population dynamics, predator/prey relationships, adaptations of seabirds to their habitats, traditional uses by people, and potential adverse impacts to seabirds and their habitats. The interdisciplinary activities are sequenced so that important concepts are built upon one another. In addition, schools requesting a workshop on this material receive a seabird slide set, a "Trashing the Oceans" video, and a NOAA marine debris information packet. (DDR)

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LEARN ABOUT SEABIRDS

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DEAR EDUCATOR,

The U.S. Fish and Wildlife Service believes that education plays a vital role in preparing young Alaskans to make wise decisions about fish and wildlife resource issues. The Service in Alaska has developed several educational curricula including "Teach about Geese," "Wetlands and Wildlife," and "The Role of Fire in Alaska." The goal of these curricula is to teach students about Alaska's natural resource topics so they will have the information and skills necessary to make informed decisions in the future.

Many species of seabirds are found in Alaska; about 86 percent of the total U.S. population of seabirds occur here. Seabirds are an important socioeconomic resource in Alaska. Seabirds are vulnerable to impacts, some caused by people and others caused by animals. The "Learn About Seabirds" teaching packet is designed to teach 4-6 grade Alaskans about Alaska's seabird populations, the worldwide significance of seabirds, and the impacts seabirds are vulnerable to.

The "Learn About Seabirds" teaching packet includes:

- * A Teacher's Background Story
- * 12 teaching activities
- * A Guide to Alaskan Seabirds
- * Zoobooks Seabirds
- * A full color poster - Help Protect Alaska's Seabirds

Topics that are covered in the packet include seabird identification, food webs, population dynamics, predator/prey relationships, adaptations of seabirds to their habitats, traditional uses by people, and potential adverse impacts to seabirds and their habitats. The interdisciplinary activities are sequenced so that important concepts build upon one another.

Training workshops can be arranged in your region to introduce these materials to teachers and other community members. Please contact the Education Coordinator at the address below to request a workshop. Those schools receiving a workshop will also receive one copy of each of the following:

- * A seabird slide set
- * "Trashing the Oceans" video
- * A NOAA marine debris information packet

As we developed this packet we solicited ideas and information from many different sources. We contacted seabird specialists, land managers, and school districts in coastal areas across Alaska. They were invited to participate in the development of the packet so that the materials would accurately portray Alaska's seabird resources and issues. Draft materials were piloted in a variety of schools and suggestions were incorporated in the final version. We would like to find out how the packet worked in your teaching situation. Suggestions will be incorporated in future printings of this packet.

Your comments are important. An evaluation sheet is included on the following page. Please fill it out and let us know what you think!

We hope that "Learn About Seabirds" will benefit young Alaskans and our seabird populations for many years to come. If you have questions or suggestions about this packet, please contact: Education Coordinator, U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503.

Thank you for teaching about Alaska's seabirds!

(Second printing, May 1995)

LEARN ABOUT SEABIRDS

CURRICULUM EVALUATION

Name (optional) _____ Phone _____ Date _____

School/Organization _____

Address _____

Grade/Subject _____ Number of students _____

Thanks for your interest in **Learn About Seabirds**. We would like to ask your assistance in improving this packet. Your responses will be incorporated into future printings of this and other educational materials. If you wish to receive updated materials and supplements, please be sure to include your name and address above and mail the completed form to:

Education Coordinator
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503

What were your goals and objectives in using these materials?

Which activities did you use? How well did they work? Do you have any suggestions for adaptations, extensions, or ways to improve the activities? (Please use an additional page if needed.)

(over please)

Please comment on the usefulness and quality of the supplemental materials (Teacher's Background Story, poster, booklets, slide set). Can you suggest other materials that we may include?

Do you feel your students gained a better understanding about the lives of seabirds and the marine environment? How were your students evaluated?

What contacts did you make or additional materials did you obtain using the "For More Information" section? Were they useful?

Do you plan to use this packet again in the future? If not, why not?

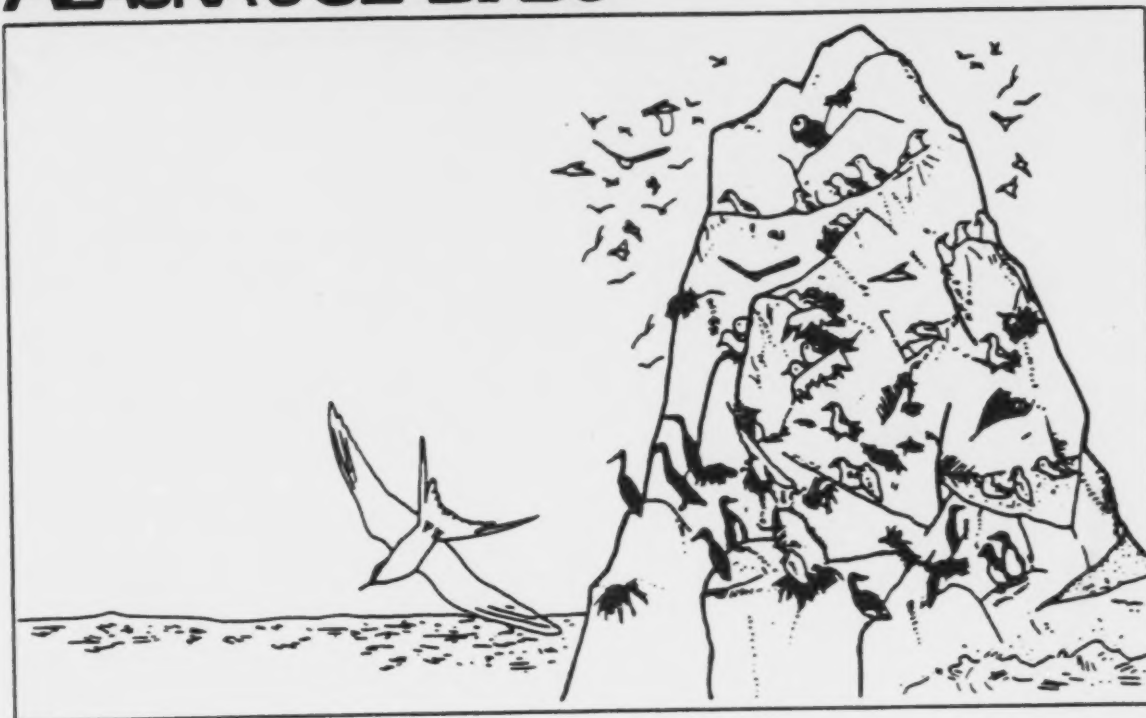
How can we further assist you? What type of supplemental information would you like to receive? (Please be sure to include your name and address on the front page.)

Any other comments or suggestions? (Please use an additional page if needed.)

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ALASKA'S SEABIRDS



A TEACHER'S BACKGROUND STORY

Can you imagine what your students will say if you ask them to name all the Alaskan communities with populations of a million or more? It's almost a secret that Alaska has some communities with a million residents along its coast. Communities that are four to five times the size of Anchorage. And not one automobile in any of them — all the residents are flyers. Know the secret? These are seabird communities!

Each summer birds that live the rest of the year on the open ocean come ashore to nest, often in noisy high rise cliff communities where each kind of bird returns to its own special neighborhood — boulder beaches, ledges, log piles, cliff tops, old trees, even caves or crevices inside the rocks and earth of the cliff.

As the accompanying *Zoobooks Seabirds* (page 1) says, seabirds are birds that spend most of their lives at sea, in the marine environment. Unless it is nesting, a seabird needs

nothing from land. Its food, water, and daily shelter (basic requirements of all life) come from the ocean. Some large seabirds (albatrosses) may even spend three years at sea before touching land. But no one has figured out how to hatch an egg on an ocean wave ... so, to survive as a species, seabirds must find solid, dry places to nest. While nesting, a seabird returns frequently to the ocean for food for itself and soon for its hungry chick. Seabirds know the ocean currents and the air currents above the waves as we humans know our grocery store aisles and subsistence places.

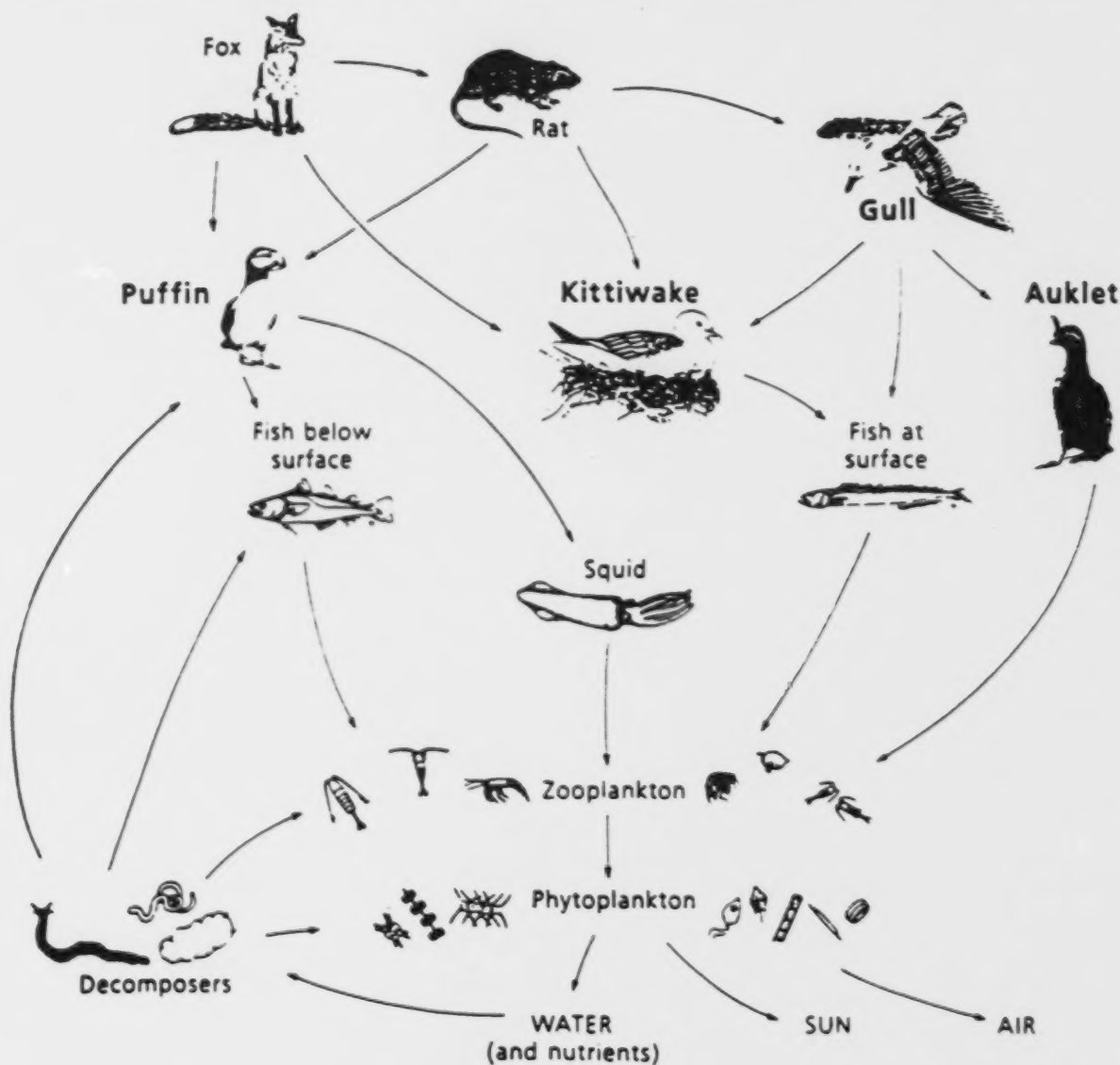
Alaska has 35 kinds of seabirds that try to raise families along its coastline. Eight of these are found only between Alaska and the Asiatic coast. All of these and five more "visiting" seabirds are illustrated and described in the accompanying red booklet, *A Guide to Alaskan Seabirds*.

FOOD WEB

Where do seabirds fit in the marine ecosystem? Here is an illustration of part of Alaska's marine food web. As on land, all energy begins with the sun. A food web weaves together many food chains (who eats what) to form the Big Picture of what happens as energy passes through the ecosystem. This web shows the relationship between producers (plants make their own food by transforming light energy) and consumers (organisms that carry this transformed energy up the food chain) and between

predators (who hunt) and prey (who are hunted).

This web goes full circle, from life to death, by showing the decomposers (bacteria and worms) that feed on all dead plants and animals, releasing energy and nutrients — all matter is recycled in an ecosystem. Shellfish include crabs, mussels, and clams. Note that seabirds help to recycle marine nutrients through their guano which fertilizes the water and land around their nesting colonies.



Marine Food Web
Arrows point to what each species eats.

HABITAT

SUMMER NESTING

When it's nesting time, what do seabirds need? A place close to the ocean (except for some gulls, murrelets, and the arctic tern that can nest and find food far inland). Coastal bluffs, rocky cliffs, and islands free of land predators are necessary. There's safety in their remoteness and isolation. And wind currents are strong in these places — important for birds that are graceful in their ocean environment but clumsy on land. They have a hard time landing and taking off, so a cliff gives them clear sailing (or falling) until they can catch a wind current.

And they choose places where hundreds, thousands, or even millions can all nest, packed together — because there is safety in numbers. And the mass of activity helps to encourage nesting behavior. These closely packed groups of nesting birds are called colonies (see the accompanying poster).

How do so many seabirds sort themselves out in those huge colonies? Each has staked its own preferred habitat (see next page), often returning to the exact place it nested last year! Some prefer beaches, hiding among rocks or drift wood (guillemots). Some like wide ledges where many of their kin can nest wing to wing (murres). Others prefer narrow, single family ledges (kittiwakes, fulmars). One kind of puffin (tufted puffin) digs a dirt burrow for its nest chamber while its cousin (horned puffin), usually hatches its egg inside cracks in the cliff face or in piles of boulders.

Several seabirds avoid the mob scene of cliff colonies, but two in particular do things really differently. Kittlitz's murrelet pairs nest alone inland in rocks found on mountainsides. The marbled murrelet, in the news recently (see clippings), may nest more than 10 miles inland in a most unusual spot — on the broad, mossy branches at the tops of ancient trees in old growth forests and on the ground. Its numbers are decreasing as those old growth forests are logged.

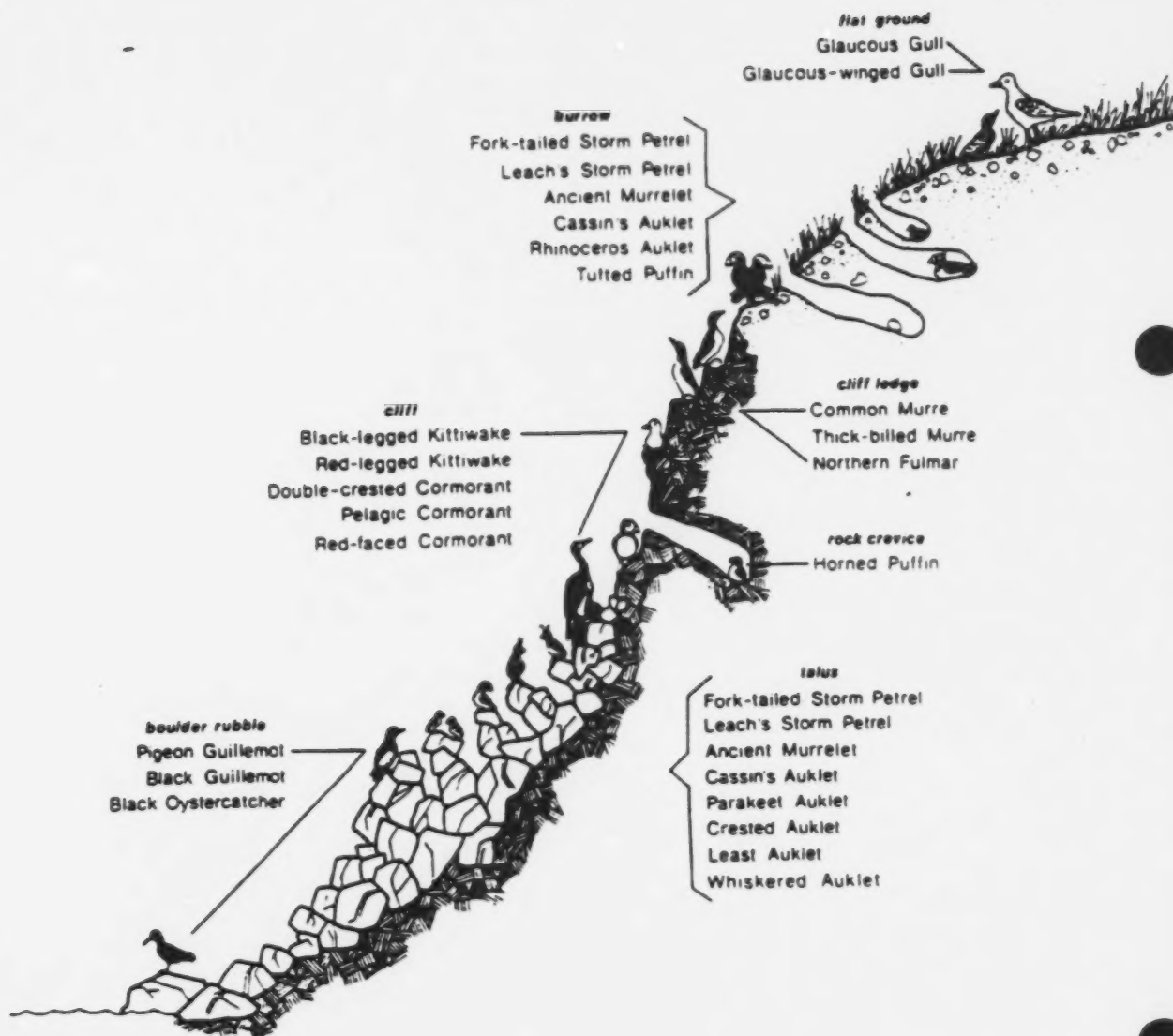
THE REST OF THE YEAR

For eight or nine months of the year, all those seabird nesting habitats are silent and empty of birds. Most seabirds are pelagic: they live on the ocean, often far offshore, with no need to set their webbed feet on dry land for the majority of the year.

On the ocean they also seek their most favorable habitat — wherever their favorite food is easy to find. Once at a spot where currents and tides concentrate fish and other foods, the seabirds further specialize by feeding at different levels in the water column. Big flocks of gulls, terns, or kittiwakes will jostle each other for fish at the surface. Cormorants, guillemots, and auklets will dive to the middle depths. The deepest fish are left for the murres and puffins.

Not as much is known about seabirds in their winter habitat. In fact, some birds' winter hangouts are still a mystery!

HABITATS OF COLONIAL SEABIRDS



PREDATORS

Although most seabirds choose nesting sites inaccessible to land predators, no places are free from predators looking for a meal. Typically, seabirds are ready to defend themselves from airborne predators — eagles, falcons, ravens. Some seabirds (some gulls and jaegers — YAY-*gr*) turn to robbing other seabirds of food being carried to a chick or they steal an uncovered egg or grab a tiny chick. But all the neighbors start calling and defending their territories and together can sometimes drive away bird intruders before they get a meal. When birds gang up on a predator in their midst, it's called mobbing.

Mammal predators usually get their meal. In the arctic, it's the arctic fox (blue fox) that is agile as a circus tightrope walker and can reach all but the narrowest ledges. Most of the Aleutian Islands and most islands south of the Alaska Peninsula and Gulf of Alaska used to be almost free of foxes. That is where many big seabird communities historically have been. But fox trappers, first Russian then American, thought those islands were cheap



places to raise foxes for their fur. Seabirds were free fox food! Some whole colonies were wiped out, and these introduced arctic and red foxes continue to prevent the return of many seabirds even today.

Another predator threatens seabirds just by the fact it might arrive on more islands: rats! See the "Human Threats" section and news clippings for details.

ADAPTATIONS

We talked earlier ("Habitat" section) about how seabirds have adapted to living on islands and cliffs safe from land predators, each preferring a special place to nest. In the ocean, the seabirds continue to separate themselves. Horned puffins look for food closer to the nest site while tufted puffins feed farther out to sea. Kittiwakes like small fish and auklets choose zooplankton. Murres dive deep while storm-petrels feed at the surface. Each seabird shares the marine resources and avoids competition by specializing — each has its own niche.

Zoobooks Seabirds shows how each seabird's bill is adapted for the kind of food it eats (page 2). It also shows how seabirds' bodies are built for flying — in air or underwater (pages 2-7). Some seabirds can fly so easily that they migrate 10,000 miles to Alaska each summer to nest (arctic terns from Antarctica) or to vacation (shearwaters, escaping the southern hemisphere winter after nesting near New Zealand and Australia). Some seabirds (auklets, puffins, murres) are built like insulated torpedoes and can fly underwater. The cormorant mixes flying above and swimming below the ocean surface; but its feathers are



The salt gland of a Northern Fulmar enables it to drink sea water, later expelling the salt.

not as waterproof as all the other diving birds, so it must stand on shore with wings outstretched to dry them after each mealtime.

"Water, water everywhere, and not a drop to drink." That's what humans would say of the salty ocean environment of seabirds. We would die if we had only saltwater to drink. But these birds have a special salt gland that lets them drink sea water — and later expel the salt.

TRADITIONS

Long ago, according to Eskimo folklore, Sedna, the daughter of the chief, was wooed by a fulmar. The fulmar won her heart and she left the comforts of her father's lodge and followed the fulmar to the ocean.

Soon, Sedna became unhappy. The fulmar was not kind to her. The other fulmars resented and mistreated her. Her father, the chief, heard that his daughter was unhappy and treated badly. He journeyed to the place of fulmars, killed her fulmar husband, and took his repentant daughter home. All the other fulmars followed, making such pitiful cries. And this is the reason, so Eskimos say, that fulmars have such a mournful cry.

HUMAN THREATS AND NATURAL DANGERS

As remote as they are, seabird communities are not safe from hazards. Ships may run aground, dump plastics and other garbage, leak fuel, or become abandoned wrecks. Oil spilling from such a ship is the first thing we think about, especially here in Alaska where many seabirds have died in such disasters. Oil coats feathers so birds cannot swim or keep warm. Seabirds are poisoned when they swallow oil — by cleaning their feathers, eating contaminated food, or drinking oily water. Oil on an eggshell can poison the chick growing inside.

Can anything be worse for seabirds than an oil spill? Yes! That grounded or wrecked ship might be infested with rats and those rats could escape to shore. Once rats infest large islands, nothing can wipe them out. They can devastate some seabird colonies by killing seabirds in even the-smallest hiding places. Generally, only preventing rats from ever getting onto an island can save its seabirds.

Weather is also a killer that seabirds cannot escape, but at least it is not permanent. Low temperatures, rain, and wind together can kill unprotected chicks. Severe storms can wash a nest off a ledge or cause a whole neighborhood to disappear in a rock slide.

Seabirds have always been a part of the life of Native peoples of Alaska. Their bones are found in the middens (waste piles) of ancient camps. Ceremonial robes made from the feathered skins of hundreds of small seabirds still exist as cultural treasures (check your nearest museum). Native hunters went to seabird colonies to gather eggs and to catch some birds with nets to provide fresh food after long arctic winters. Whalers and explorers also killed seabirds for food.

Some villages today make a special time for traveling to nearby seabird cliffs to gather eggs early in the season. Others seek eggs from birds nesting on flat ground near their villages. These first eggs of the season still provide a welcome change from a winter diet and give families a chance to share traditional activities.



Humans walking in some seabird colonies can scare birds off their nests, exposing them to rain and wind. While the parent birds are gone, a gull can grab unguarded eggs or chicks. Aircraft flying too low can cause birds to fly, knocking off eggs in their panic to escape. Boats cruising too close to the cliffs can do the same thing. Aerial predators then have a feast on unguarded eggs and chicks.

The parent seabirds must be able to find enough food for themselves and their chick within a timely distance from the nesting colony or the chick will starve waiting. Sometimes ocean currents move fish away from islands, or fishermen in the area catch too many fish, forcing the adults to fly farther and farther. Sometimes even adult seabirds starve to death.

People catching fish sometimes set their nets or lines right where seabirds are looking for food. Birds can get caught in fishing nets and drown.

Ocean pollution also can be deadly. Seabirds starve to death when they become tangled in things people throw away — fishing line and and nets, plastic six-pack rings, for example.

Or seabirds may eat small pieces of trash (such as plastic pellets that fall out of styrofoam) mistaking it for food. This plastic collects in their digestive system, eventually killing them.

Many of these threats to seabirds are illustrated on the poster that accompanies this packet.

YOU CAN HELP

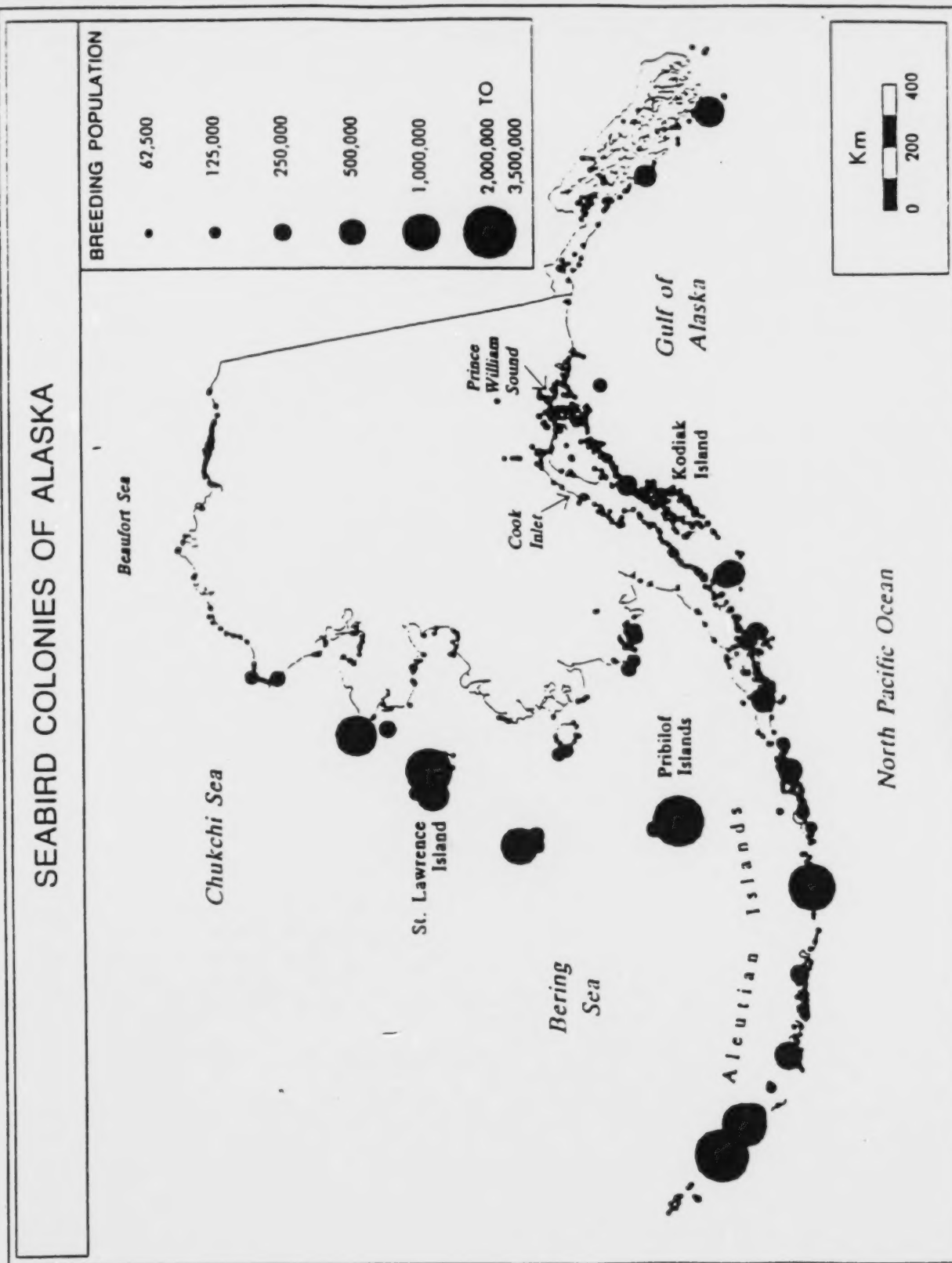
Life for a seabird has many threats. Humans have control over only a few — but seabirds need all the help they can get! Challenge your students to think of ways to help, from local action around seabird colonies to suggestions for community and government leaders. Many seabirds lay only one egg each year. The chances are slim that each egg will hatch and produce an adult. You can improve those chances.

A list of ideas appears in the activity "Can Do!" on page 52.

Some communities have already become active protectors of their seabirds and the marine ecosystem. Many colonies are part of state or federal wildlife refuges — ask someone from a nearby refuge to come to your classroom. Biologists often spend the summer studying the health of seabird colonies: whether numbers of birds or chicks are changing; what the birds are finding to eat, for example. Encourage your students to talk with these scientists and share information.

A list of people to contact at federal agencies in Alaska appears in the "For More Information" section on page 56.





This map was produced by the Alaska Seabird Colony Catalog computer database, U.S. Fish and Wildlife Service, 1994. For more detailed maps showing bird colonies in your area, contact Dr. Vivian Mendenhall, Migratory Bird Management, U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99503. Phone: (907)786-3517.

GOIN' BIRD WATCHING



PROCEDURE:

1. Assign students in your class to each of the "parts" in the cast of "Goin' Bird Watching". Their role is to say their line (words in parentheses) whenever their part is mentioned.

CAST:

wildlife photographer (say cheese! click)
kittiwakes (kittiwake, kittiwake)
waves (crash, crash)
puffins (silently flap arms very quickly like a puffin)
raven (caw, caw)
murres (bruaaa, bruaaa)
wind (wooooooosh)
guano (pee-u!)(while holding nose)

2. Read the story on the following pages aloud, pausing for the sound effects of the cast.

GOIN' BIRD WATCHING

One summer day, my friend and I planned to get up very early for our hike to (name of a local seabird colony) near (name of your village or town). My friend was determined to become a **wildlife photographer** (say cheese! click). At the crack of dawn - well, it was really more like 10 a.m. - we headed out. As we got close to our destination, we heard the faint sound of **kittiwakes** (kittiwake, kittiwake). A small flock of **kittiwakes** (kittiwake, kittiwake) flew towards us overhead, calling noisily to each other. As we got closer to the ocean, the **wind** (woooooosh!) became stronger. It was blowing right in our faces and was very refreshing, except that the **wind** (woooooosh!) also carried the fishy smell of **guano** (pee-u!). We knew we were getting close to a big colony of seabirds! Even though the **guano** (pee-u!) was really smelly, we knew the **guano** (pee-u!) is good fertilizer for the surrounding ocean.

We slowly crept up to the top of the cliff, being very careful not to get too close to the edge. As we peeked over the edge, we saw the **waves** (crash, crash) crashing on the rocks below. We found a safe spot to sit down, and my friend the **wildlife photographer** (say cheese! click) got her camera ready. To our left we could see a whole bunch of **murres** (bruaaa, bruaaa) standing very close to each other on a narrow cliff ledge. It sounded to me like the **murres** (bruaaa, bruaaa) were telling jokes to each other and laughing. Just as my friend the **wildlife photographer** (say cheese! click) was about to take a picture of the **murres** (bruaaa, bruaaa), a big, black **raven** (caw, caw) flew by, soaring on the **wind** (woooooosh!). The **raven** (caw, caw) is one of the few predators that can reach seabirds nesting on cliffs. The **raven** (caw, caw) was looking for dinner. The **murres** (bruaaa, bruaaa) were frightened and jumped from the ledge and flew out over the **waves** (crash, crash). Today was not the **raven's** (caw, caw) lucky day - no eggs were to be found.

Suddenly my friend the **wildlife photographer** (say cheese! click) got very excited. She had spotted a **puffin** (flap arms) flying towards us. I

just had to laugh because with its short stubby wings and short stubby body that **puffin** (flap arms) was flapping so hard it looked more like a flying potato than a bird! But my friend said that the **puffin's** (flap arms) wings are so short because it can fly really well under water to chase and catch fish. I was amazed. Imagine that! A **puffin** (flap arms) flying under the **waves** (crash, crash).

My friend the **wildlife photographer** (say cheese! click) was very happy because she got several good pictures of the **puffin** (flap arms) as it landed on the cliff near us. In fact, she took so many pictures that soon she ran out of film. Finally, we just laid back in the grass and looked up at the sky. The **wind** (wooooooosh!) blew over our faces, and we could still smell the **guano** (pee-u!), though believe it or not we had kind of gotten used to the smell. As we looked at the sky, it turned beautiful shades of pink and gold as the sun began to set. Another flock of **kit-tiwakes** (kittiwake, kittiwake) flew overhead, and we waved goodbye to them. What a great day we'd had with the seabirds.

Adapted from: *Wetlands and Wildlife*, U.S. Fish and Wildlife Service.

ZOOBOOK SEABIRDS



OBJECTIVE:

Students will gain an introduction to seabirds through observing, listening, sharing and note taking.

BACKGROUND:

Alaska has a huge population of seabirds, the largest in North America. The accompanying red booklet, *A Guide to Alaskan Seabirds*, can be used as a *Who's Who* for the 40 kinds of seabirds in our marine environment. The booklet tells where you might see each bird, identifying characteristics, and interesting facts about its life.

Zoobooks Seabirds also included with this curriculum gives an overview of seabirds found throughout the world. Many of the species pictured in *Zoobooks Seabirds* do not live in Alaska; however, their habits and life histories are similar to more familiar Alaskan species. Thus the booklet provides a colorful and fun base for discussion and comparison, especially when used with the "Help Protect Alaska's Seabirds" poster. This lesson outlines just one way a teacher or

instructor could present the information in *Zoobooks Seabirds* to a group of students.

MATERIALS:

- large sheet of bulletin board paper
- markers of several colors
- copy of *Zoobooks Seabirds* (included in this packet)
- copy of *A Guide to Alaskan Seabirds* (included in this packet)
- "Help Protect Alaska's Seabirds" poster (included in this packet)

More copies of Zoobooks Seabirds and A Guide to Alaskan Seabirds may be purchased from the Alaska Natural History Association using the order form included at the end of this curriculum.

PROCEDURE:

1. Seat students on floor so they can see *Zoobooks Seabirds*. Ask students to describe in detail what they see on the cover. The object is observation, not identification (i.e. "How long is its beak

compared to its head? Describe the beak", etc.) Acknowledge good observation skills.

2. Ask the question, "How is a seabird different from other birds?". Use a bubbling or cluster form of diagramming to record students' answers on a large sheet of bulletin board paper. Put the word "Seabird" in the center and paraphrase some of the rays or bubbles into Habitat, Food, and Adaptations. Adaptations may be further broken down into subcategories, such as feeding, flight, swimming/diving, and nesting. Ask elaborating questions. Do seabirds live at sea all the time? When do they not live at sea? Why? Ask students to make an inference (an informed guess) about what the birds on the cover are doing.

3. Tell the students that you are going to show the pictures from each page for 15 seconds, but you are not going to read the text to them. Ask them to look for clues about what seabirds eat, where they nest, and seabird colors. Show the pictures. Go back to the diagram and record. What do seabirds eat? How do seabirds eat? Where do they live? Where do they nest? What are the most common seabird colors? Where would you put this information on our diagram? Why do you think seabirds are usually lightly colored below and darker on top?

4. Point out to students that seabirds live all around the world. Some of the birds will be familiar, some strange and some will be related to birds they know. Write the word "Pelagic" on the diagram. Tell the students that this is a word that describes many seabirds. Ask them to listen for its definition. Inform them that the first two pages deal with amazing seabird facts. Read aloud all the text on the first two pages. Record favorite facts. Ask students to point out Alaska species, and non-Alaska species. Explain that the Atlantic puffin is related to our horned puffin and tufted puffin. Record the definition of pelagic on the diagram. ("Pelagic" means "open ocean". Pe-

lagic seabirds spend almost all of their life in the open ocean and come ashore only to raise their young.)

5. Read aloud pages 2-3. Point out that the only Alaska seabirds represented are the albatross and gull. Have students list some facts about seabird flight to record on the diagram.

6. Pages 4-5 talk specifically about how seabirds not only survive but thrive by living on the sea. After reading the text aloud, ask elaborating questions focusing on the adaptations of vision, underwater flight, and salt removal. Record responses on the diagram.

7. On pages 6-7 the most prominent drawing about feeding is the pelican - a bird the students are not likely to see in Alaska. However, all other birds pictured demonstrate feeding behaviors used by Alaskan seabirds. Read the text aloud, ask questions, and record answers on the diagram. This is a good time to ask students to share stories. Have you ever seen a bird feed in one of these ways?

8. Pages 10-11 on bird communication feature Alaska birds only on the sidebars. If your community is located near a seabird colony the students might be familiar with some forms of seabird communication, but it would be likely that many subtle displays such as skypointing may be missed by all but the most careful observer.

9. The pelican takes center stage for pages 12-13, but Alaska birds are featured along the perimeter. What is the difference between a puffin's nest and a murre's nest? Why is a murre egg shaped that way? What is a colony?

10. Pages 14-15 highlight different threats to seabirds. What is the major threat to seabirds in your area? In Alaska introduced species, such as foxes and rats, are among the biggest threats. Are these two animals threats to seabird colonies you know about?

EXTENSIONS:

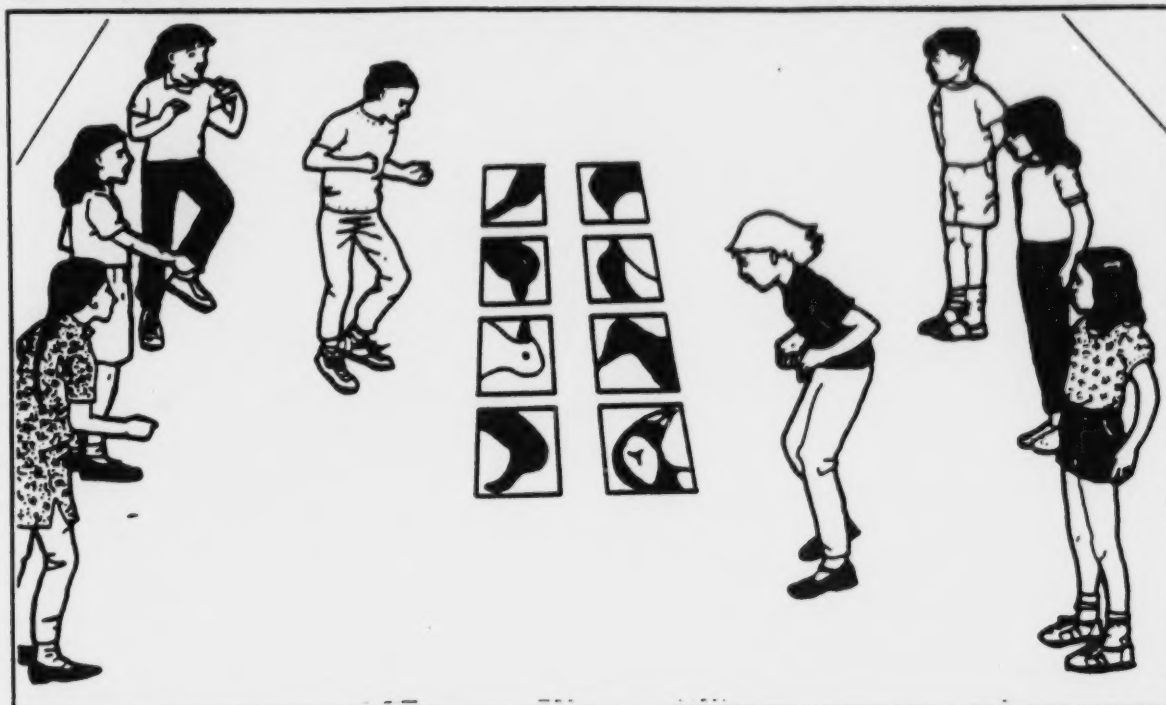
1. Hang your bulletin board diagram in the class. Ask students to add facts in the appropriate place when they learn something new.

2. During discussion of one of the topics, such as feeding or bird communication, many students may want to share. Their

stories and observations can be written as a language arts assignment.

3. In the activity "Create A Cliff", students will research a seabird. Have them collect information on their bird using the bubble diagramming technique used in this activity. Encourage them to use the class notes as a model for their own bird notes.

SEABIRD IDENTIFICATION LINE GAME



OBJECTIVE:

To reinforce seabird identification skills and knowledge about seabirds.

BACKGROUND:

Seabirds are unlike any bird you would find on land. Their bills, bodies, and coloration are adapted for life in three worlds — water, air, and land. Some of the seabirds fly underwater as well as in the air. That means they must be streamlined in shape yet compact enough to conserve their body temperature in the cold ocean. They must be able to catch slippery food in the water and, in the summer, carry it while flying many miles to their hungry chicks.

All these adaptations are reflected in the seabirds' shapes. By studying and coloring the seabird images, students can begin to see these adaptations as well as learn to identify a variety of seabirds. They can use these pictures for the line game described below or to illustrate a story they write about seabirds.

This activity is best used as a review or for further depth after students have become familiar with seabirds. For winter observers, please note: Some of the seabirds' identifying features (the puffin's colorful, parrot-like bill or its punk feather tufts) are present only in summer to help attract mates. Refer to the range maps in the red booklet, *A Guide to Alaskan Seabirds*, to learn which seabirds might be in your vicinity.

MATERIALS:

- one set of seabird coloring pages for each student, masters provided

PROCEDURE:

1. Have students color their seabird pages, using the correct colors as indicated in the key. Point out and discuss the distinguishing features of each bird. When they have finished coloring, the students may put them together as a booklet to be used as a field guide to use during a visit to a colony.

Or any of the pictures could be used to illustrate a story they write about seabirds.

2. For the identification line game, you will need two pictures of each seabird species. You may wish to begin with just 3 or 4 common species and gradually add more species as the students' knowledge improves. Use pictures colored by students or make your own, making sure the name of the bird is not on the picture. You may wish to laminate them.

3. Form two equal teams and line them up, one team facing the other, 15 feet apart. Put the pictures, 2 of each species, in a row on the ground between the two teams. Be sure everyone can see the pictures. The teams count off separately, so that each team has a player number one, two, three, etc. Like numbers from each team face each other.

4. When the teams are ready, call out the name of a bird pictured on the cards lying between the teams, then call out a number. (To add to the surprise, call the numbers out of sequence.) For example, "tufted puffin, number three". Say the number after the bird name, so that everyone is looking for the correct answer, not just the people whose number is called.

5. As soon as the "threes" hear their number called, they race to the cards, trying to be the first to pick up the card with the picture of the tufted puffin. After picking up the card, they return to their team. The team should agree that the correct picture has been chosen. If not, player three can go back and get another card. Every successful player earns a point for his or her team. Since there are two cards of each species, it is possible for both teams to earn a point each round.

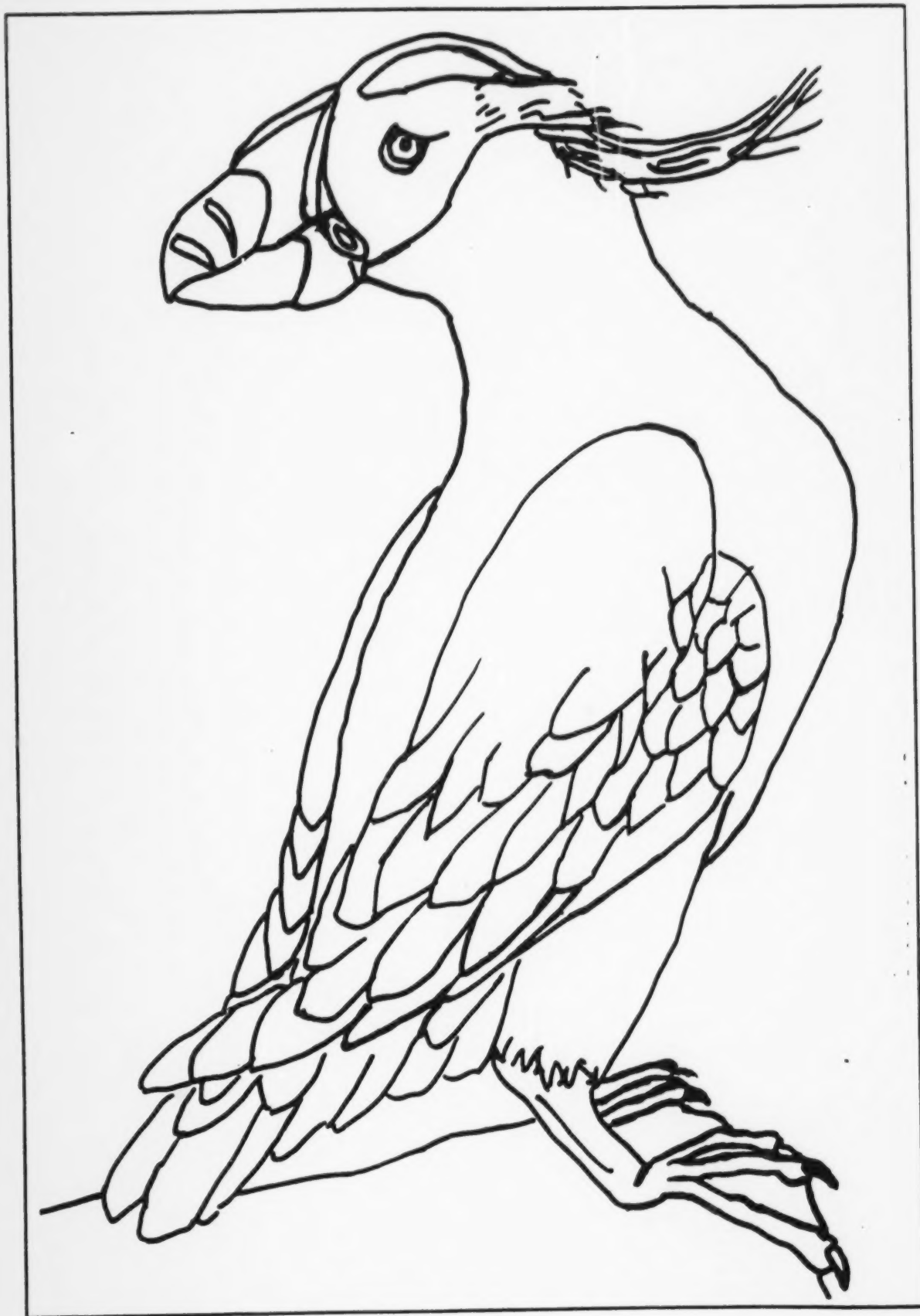
6. Facts about the birds can also be reviewed by making statements such as: "The seabird that has a very large orange bill, yellowish tufts on its head, and nests in burrows" (Tufted Puffin); "Ninety-seven percent of the world's population of this seabird nests on St. George Island in the Pribilofs" (Red-Legged Kittiwake); "This seabird makes a very high-pitched whistle, and the inside of its mouth is bright red" (Pigeon Guillemot); "This seabird nests in large, tightly-packed groups on cliff ledges and does not build a nest" (Common Murre); "In some areas of Alaska this bird is called the Sea Parrot" (Horned Puffin); "This seabird feeds on zooplankton, which it gathers by swimming underwater with its wings" (Parakeet Auklet); "This seabird chases fish underwater by swimming with its feet. Its feathers are not waterproof so it must hang them out to dry" (Pelagic Cormorant); or "This bird has the longest known migration, travelling 11,000 miles to winter in the Antarctic" (Arctic Tern).

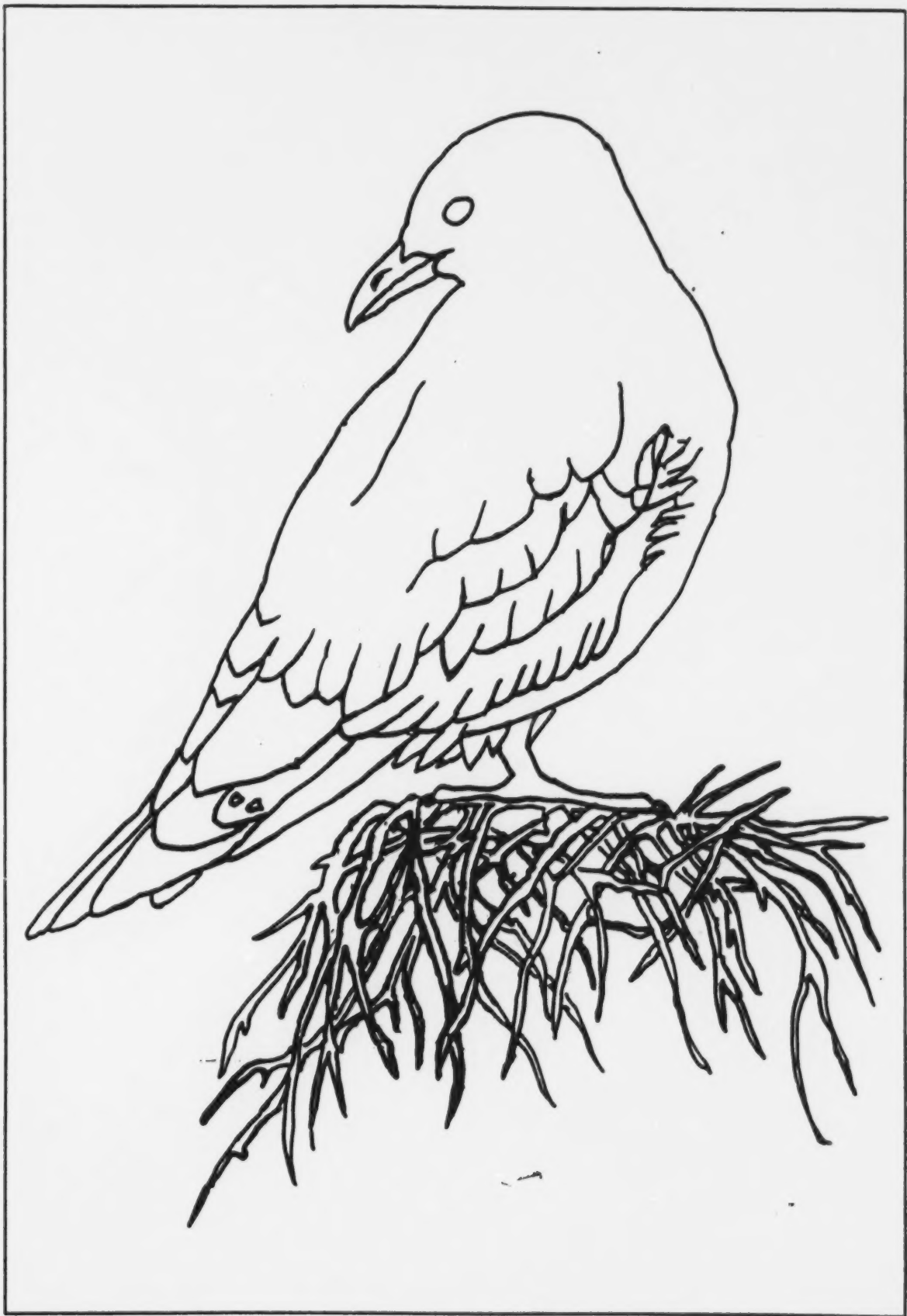
Names of the birds in Native languages may also be used. Refer to the chart of Native names for seabirds on pages 46 and 47.

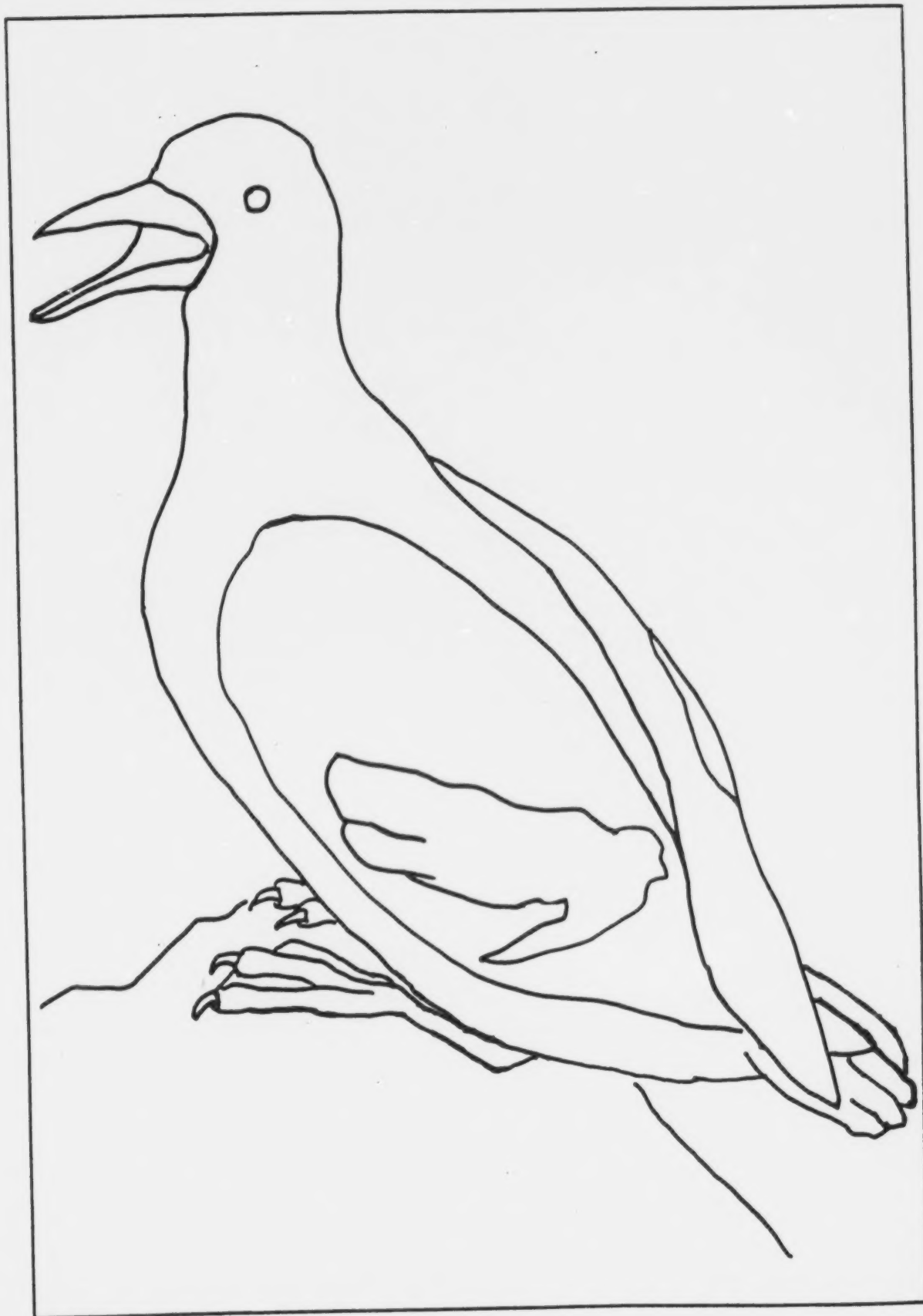
EXTENSIONS:

If possible, visit a seabird colony. Bring binoculars and identification books. Record and sketch observations using the Seabird Checklist included with this activity. The Seabird Checklist is designed to help students observe birds and record identifying characteristics, including bird size, bill shape, wing shape, tail shape, nest site, coloration, and feeding method.

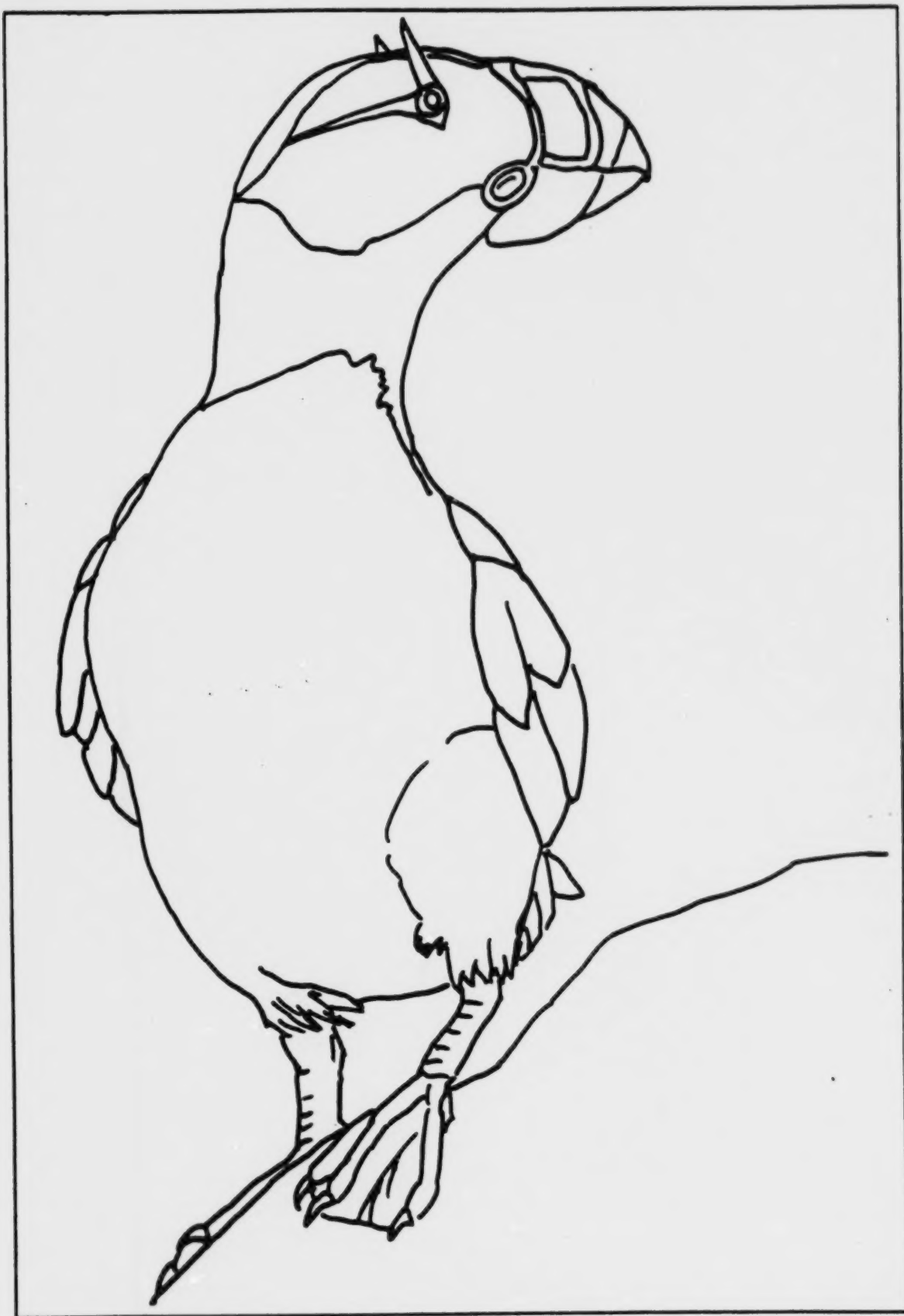
Adapted from: *Teach About Geese*, U.S. Fish and Wildlife Service.

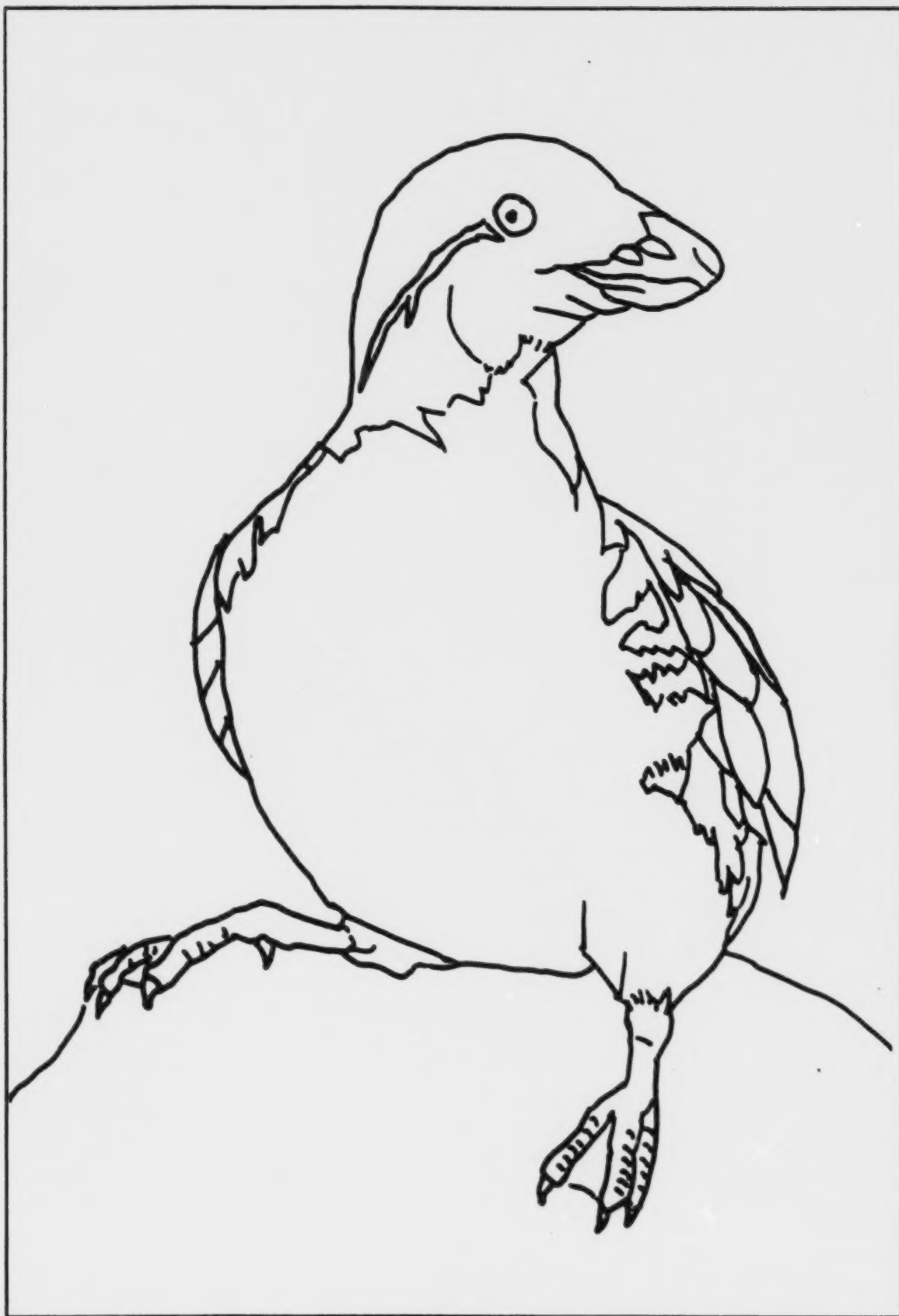


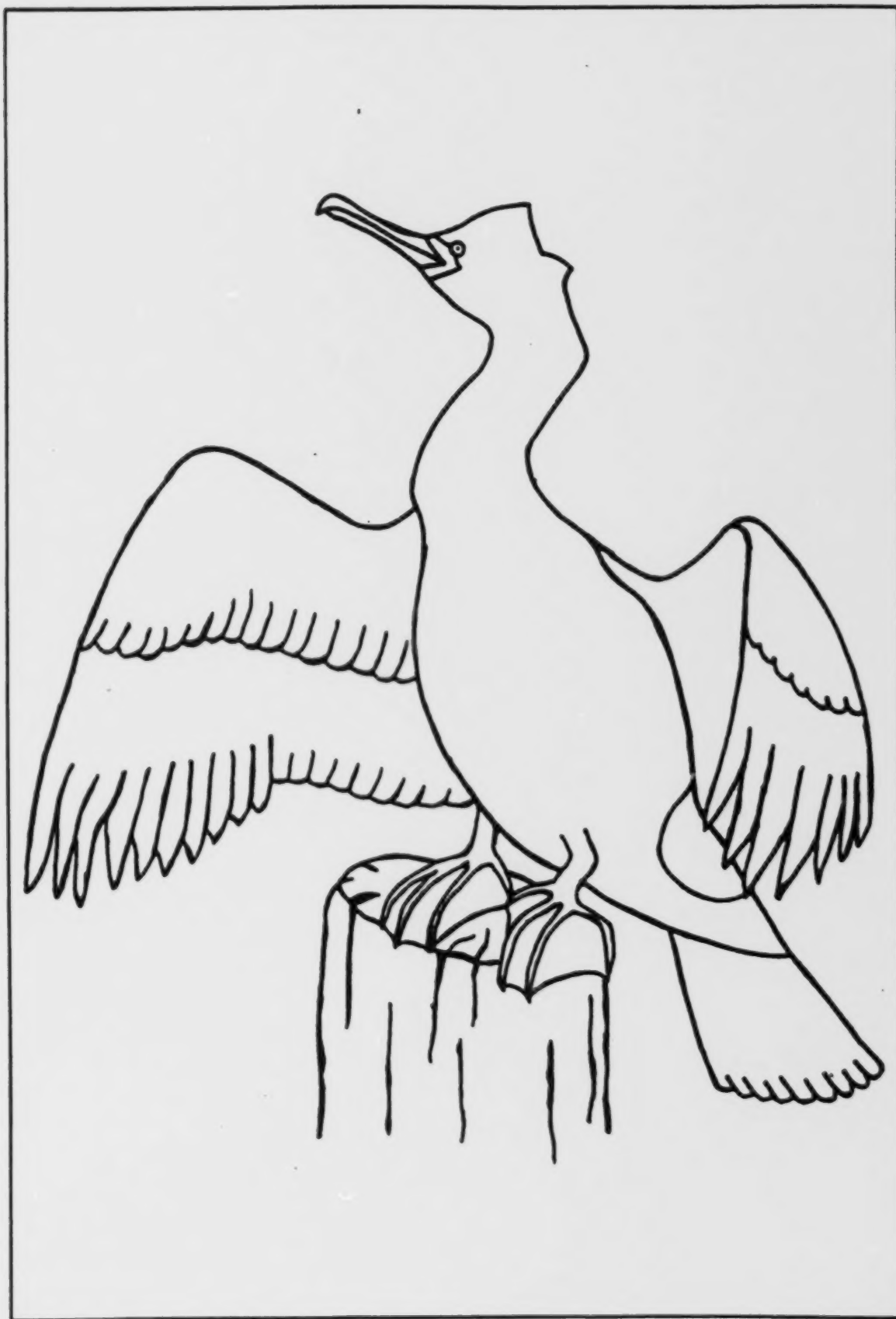


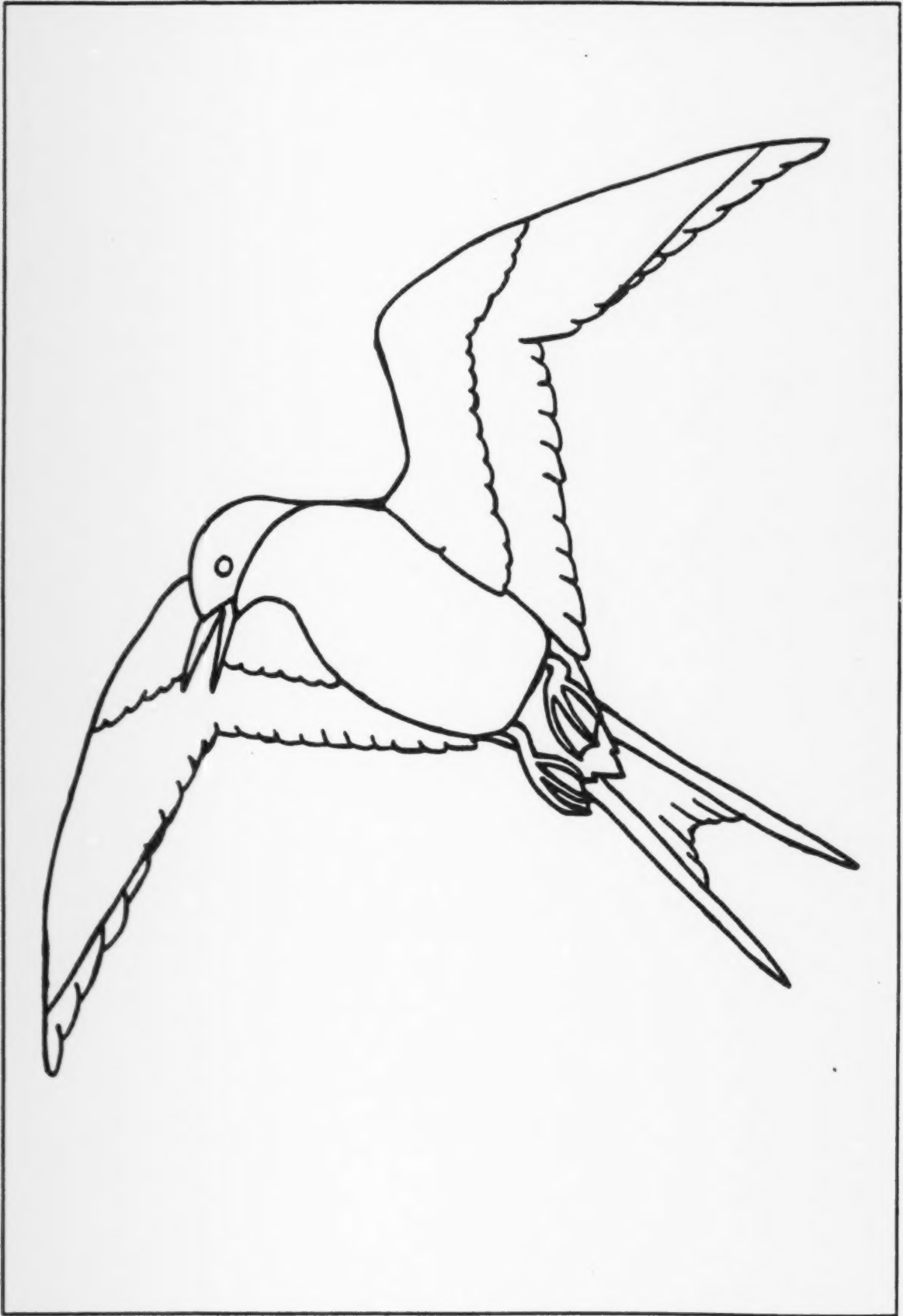










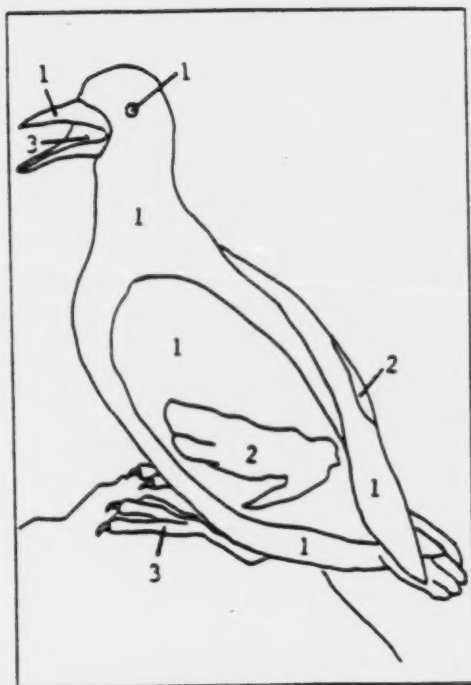




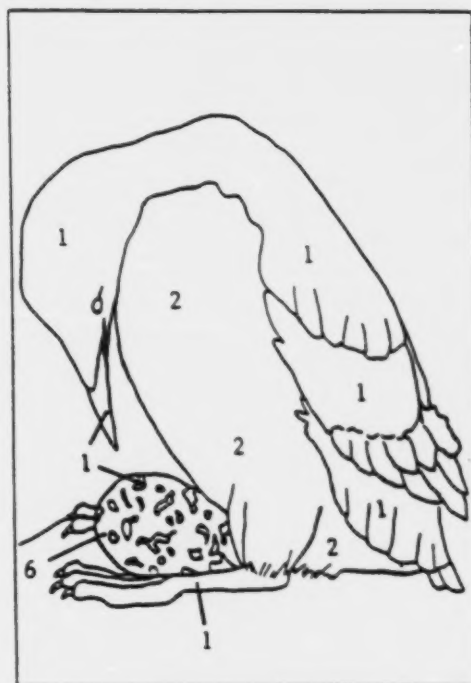
Tufted Puffin



Red-legged or Black-legged Kittiwake



Pigeon Guillemot



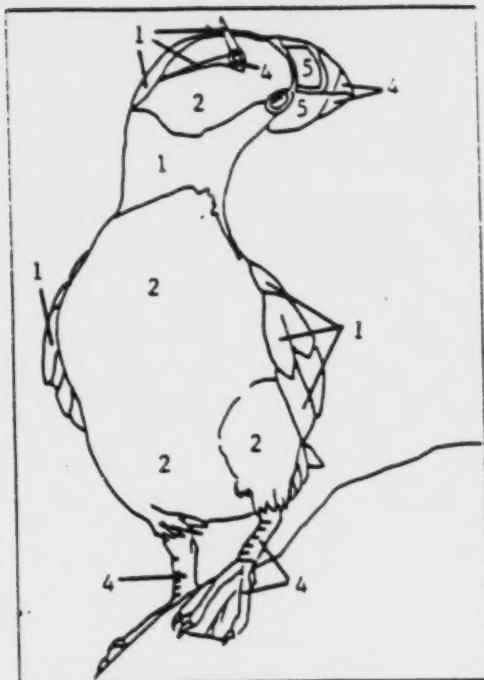
Common Murre

1 = black
2 = white

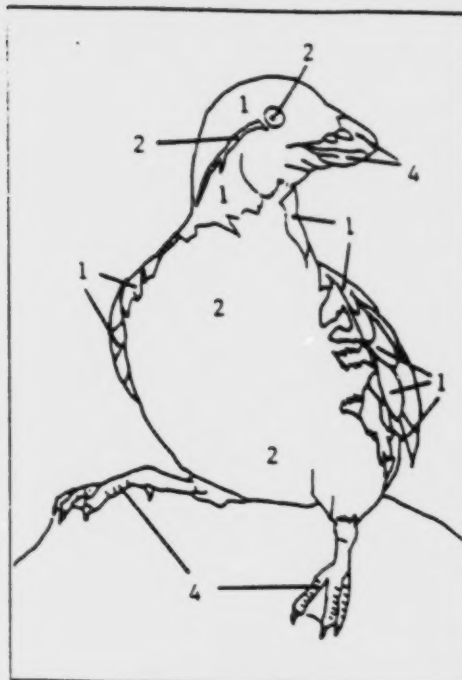
3 = red
4 = orange

5 = yellow
6 = blue/green

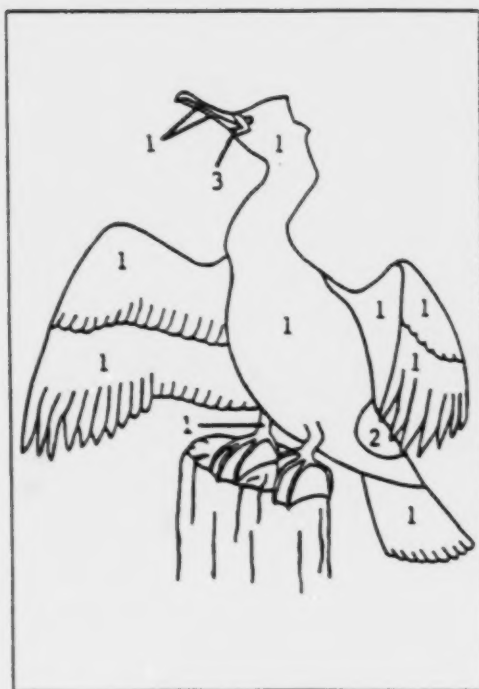
7 = gray



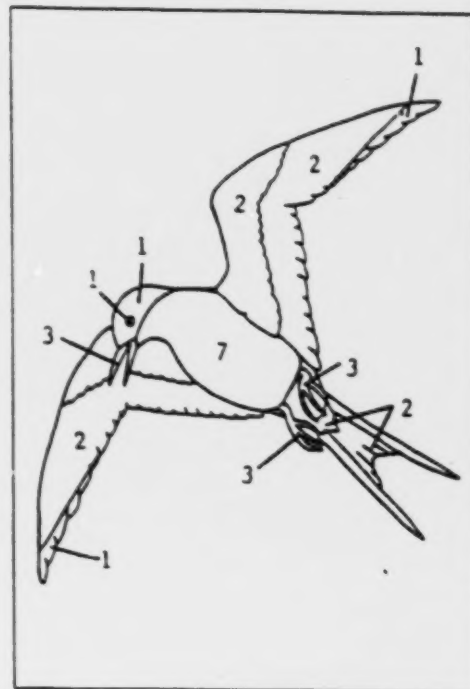
Horned Puffin



Parakeet Auklet



Pelagic Cormorant



Arctic Tern

1 = black
2 = white

3 = red
4 = orange

5 = yellow
6 = blue/green

7 = gray

Seabird Identification Checklist

Bird Size	Bill Shape	Wing Shape	Tail Shape	Feeding Method	Nesting Site	Bird Name

27

Draw or write the shape of the bill, wing, and tail in the space above with the help of these examples:

Bill Shape:

Long, pointed



Short, stubby



Long, hooked



Long, tube nose



Wing Shape:

Short, round



Long, pointed



Tail Shape:

Rounded



Forked



Square



Long feathers in center



Draw the whole bird on the back of the page, if you'd like.

Write the bird's size, feeding method and type of nest site in the space above with the help of these examples:

Bird Size:

Smaller than a duck

Duck size

Larger than a duck

Feeding Method:

Dives from air to surface

Sits on surface and feeds

Dives under water

Other

Nest Site:

Flat ground

Burrow or crevice

Ledge of cliff

Rock piles

Forest

Other

FOOD CHAIN RUMMY



OBJECTIVE:

Students will develop an understanding of marine food chains and food webs by playing a card game in which food chains including seabirds are assembled.

BACKGROUND:

Life at sea (as on land) is an eat or be eaten world. Organisms being eaten are **prey** and the hunters are the **predators**. A **food chain** is the simplest way of showing who eats whom and the transfer of energy from the sun, through plants, to animals.

All food chains start with the sun. Plants are able to use the sun's energy (through **photosynthesis**) to make chemical energy and store it as a source of food. Because plants can produce their own food, they are called **primary producers**. In the ocean, most primary producers are single-celled plants called **phytoplankton** (which includes diatoms and dinoflagellates).

Animals that eat plants are called **primary consumers**. In the ocean, most primary

consumers are tiny animals called **zooplankton** which include small crustaceans such as krill, amphipods, and copepods. **Secondary consumers** eat primary consumers. Some seabirds, mainly auklets, are secondary consumers because they feed directly on zooplankton. Many fish are also secondary consumers. Seabirds, such as cormorants, that eat these fish are called **tertiary** or third level consumers.

Decomposers are the recyclers at the end of each food chain, breaking down dead plant and animal material to return the nutrients to the system.

Each kind of seabird eats just a few kinds of food (**prey**). A food chain for a cormorant might contain:

Sun — Phytoplankton — Zooplankton — Sandlance (or Capelin or Pollock) — Cormorant — Glaucous-winged Gull — Worms or Bacteria.

The cormorant does not eat zooplankton, which is too small for it, and it does not eat other seabirds — but the gull does! (Gulls can eat eggs and chicks as well as fish and mussels). Humans are part of a marine food chain when we eat clams, crab, fish, or a seabird egg. Combining all the food chains makes a food web. A marine food web is illustrated in the Teacher's Background Story.

MATERIALS:

- one deck of 60 food chain cards for each group of 3-4 students (two copies of masters provided)

PROCEDURE:

1. Using the masters provided, make sets of 60 cards. Each master must be copied twice for each set. Glue the cards to heavy stock paper. Laminate them if possible. Make sure each group has a set containing all 60 playing cards.
2. Place students in groups of 3 to 4. Each group receives one deck of 60 cards. Dealer shuffles and deals out five cards to each player and herself and places the rest of the cards face down in the center.
3. The dealer then takes the top card from the deck. She must discard either the card picked up from the top of the deck or one from her hand and place it face up in the discard pile.
4. The next player can take the top card on the discard pile or a card from the top of the deck. He checks his hand and must discard one card.
5. If a player draws a "Death Card" (rat) from the deck, he must immediately declare that rats have invaded his colony. The player then must sit out for the rest of the game. If a player is dealt a rat card in the opening hand, he may discard it without penalty.
6. The game continues until one person gets a hand consisting of five cards that make a true food chain and announces "Food Chain Rummy!" Each card lists what that animal eats. Refer to the foods listed on the cards to check the hand and make sure that it is a believable food chain. Every

food chain must include the sun, a primary producer (phytoplankton), a primary consumer (zooplankton), a secondary consumer (herring, pollock, capelin, sandlance, squid, parakeet auklet, crested auklet, or least auklet), and a tertiary consumer (common murre, horned puffin, thick-billed murre, cormorant, tufted puffin, northern fulmar, human, glaucous-winged gull, raven, fox or bald eagle). Note that the *only* seabird in this game that preys on other seabirds is the glaucous-winged gull. In no other instance does one seabird feed on another seabird. If a student declares a winning hand and the food chain is not believable, that student must wait out two turns before she can draw a card. If the declared food chain is possible, she is declared the first winner and sits out while play continues.

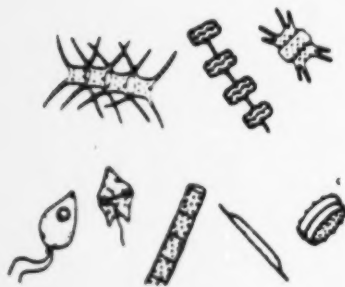
7. Play continues until the second, third and fourth winners have completed a food chain.

8. At the end of the game, have the students connect their food chains into a food web.

EXTENSIONS:

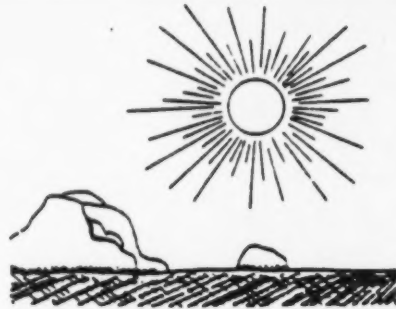
1. Discuss the predator-prey relationships within the food chains. What happens when a predator population or prey population increases or decreases? (Seabirds may abandon their nests or die when prey is scarce.)
2. Discuss competition for food sources. Do all seabirds compete for the same food? (No. Different species have different feeding methods. Some take food at the surface, some dive very deep, some eat zooplankton, some eat different species of fish.) What other animals compete with seabirds for food?
3. Humans are an intricate part of most marine food webs. We obtain many food items from the sea. In what ways might we compete with seabirds for food? Do we compete with other animals too?

Adapted from: *Wetland Activities*, Louisiana Department of Wildlife and Fisheries, Louisiana Sea Grant College Program.



Phytoplankton

I am a single-celled plant.
I get my energy from the sun.



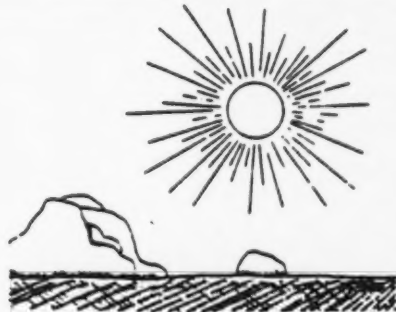
Sun

I am the beginning of the food chain.
Plants (including phytoplankton) use
my energy to make food.



Phytoplankton

I am a single-celled plant.
I get my energy from the sun.



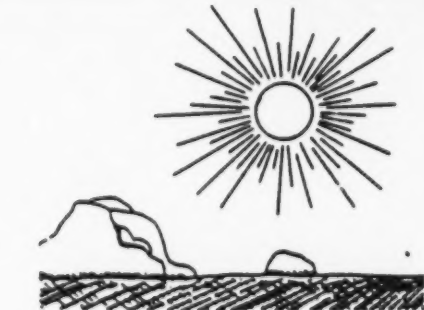
Sun

I am the beginning of the food chain.
Plants (including phytoplankton) use
my energy to make food.



Phytoplankton

I am a single-celled plant.
I get my energy from the sun.



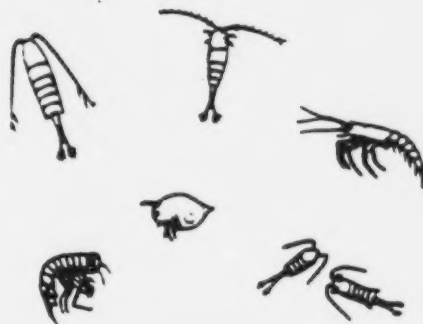
Sun

I am the beginning of the food chain.
Plants (including phytoplankton) use
my energy to make food.



Walleye Pollock

I eat zooplankton.
I also eat little walleye pollock.



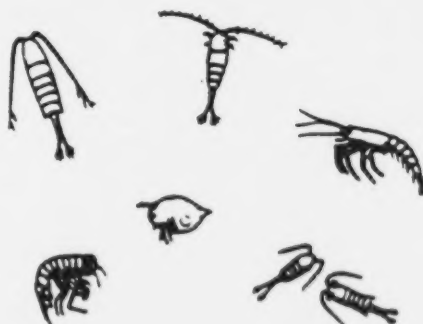
Zooplankton

I eat phytoplankton.



Pacific Herring

I eat zooplankton.



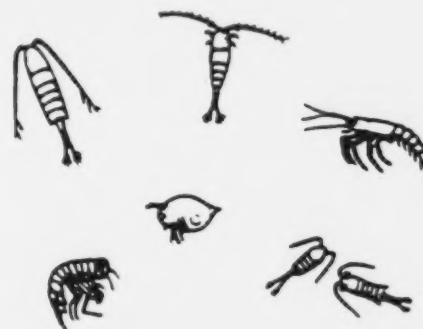
Zooplankton

I eat phytoplankton.



Squid

I eat zooplankton.



Zooplankton

I eat phytoplankton.



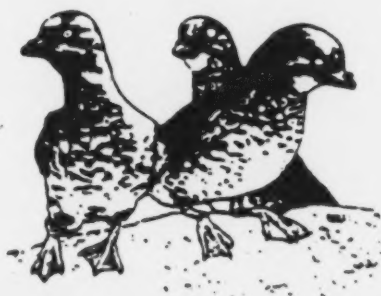
Northern Fulmar

I eat fish such as capelin, sandlance, and pollock. I also eat squid.



Crested Auklet

I eat zooplankton.



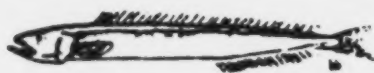
Least Auklet

I eat zooplankton.



Parakeet Auklet

I eat zooplankton.



Sandlance

I eat phytoplankton and zooplankton.



Capelin

I eat zooplankton.



Common Murre

I eat fish such as capelin, pollock, and sandlance.



Tufted Puffin

I eat fish such as capelin, sandlance, and pollock.
I also eat squid and zooplankton.



Kittiwake

I eat fish such as sandlance, capelin, and pollock.



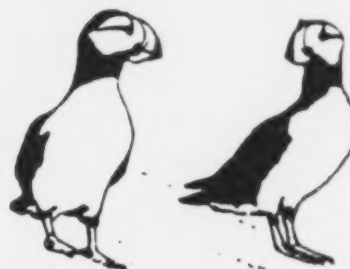
Cormorant

I eat fish such as sandlance, capelin, pollock, and others.



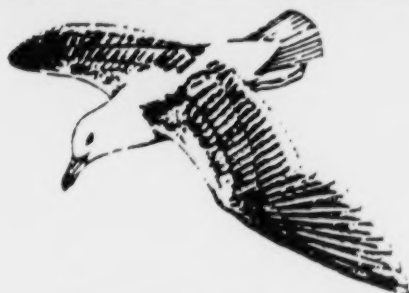
Marbled Murrelet

I eat fish such as sandlance, pollock, and capelin.



Horned Puffin

I eat fish such as capelin, sandlance, and pollock.
I also eat squid and zooplankton.



Glaucous-winged Gull

I eat many kinds of fish including pollock, capelin and sandlance. I also eat other seabirds and their eggs (even though I am a seabird too).



Human

I eat many things from the sea including pollock, herring, and seabirds and their eggs.



Raven

I eat small rodents, dead animals, garbage from humans, and seabirds and their eggs.



Fox

I eat small rodents, garbage from humans, and seabirds and their eggs.



Bald Eagle

I eat small rodents and other birds, including seabirds.

DEATH CARD

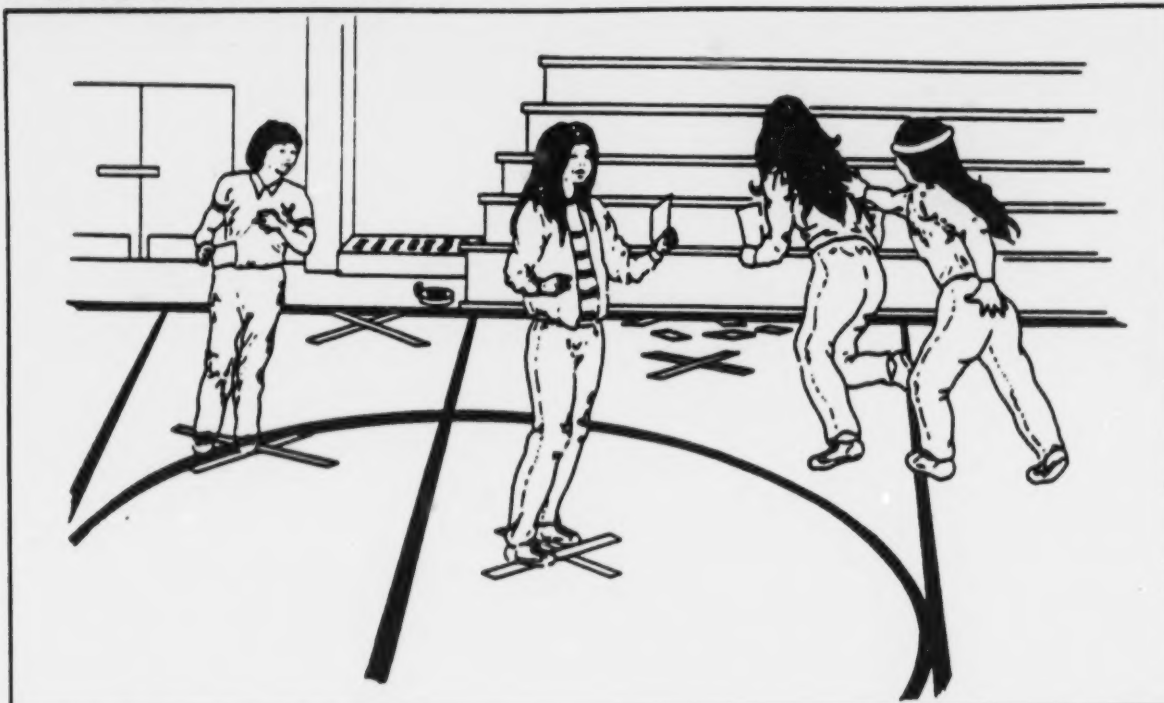
*Rats have invaded your seabird colony!
The food chain is in trouble and
you are out of the game.*



RAT

I eat many things, including seabirds and seabird eggs.

HABITAT TAG



OBJECTIVE:

In a highly active game, students will learn that all animals including seabirds must have food, clean water, shelter and space to survive, and about the impact humans can have on habitat and wildlife species.

BACKGROUND:

Every living creature requires specific kinds and quantities of food, water, shelter and space in a suitable arrangement. These needs are called **habitat requirements**. Different birds and animals live in different habitats because they have different habitat requirements. For seabirds, the open ocean provides all habitat requirements during winter. During the summer nesting season seabirds require the shelter of land, usually protected cliffs and coastal areas, to raise their young.

In this tag game, each bird must find its habitat requirements in order to survive. Predators get food by capturing (tagging) prey. The habitat component in shortest

supply determines the number of animals that can survive. This is known as the **limiting factor**. Humans can change the available habitat in many ways. They can damage food and water sources, introduce disease and parasites, destroy shelter, overfish, kill predator and prey species, or introduce (accidentally or intentionally) new predator species such as rats and foxes.

The greatest threat to Alaska's seabirds is NOT an oil spill; it is the escape of rats onto seabird nesting islands. Since rats are not native to Alaska, seabirds have no way to defend themselves from this highly effective predator. Rats could escape from visiting boats or barges, or from vessels that have run aground. Rats are capable of wiping out seabird colonies because their size and agility lets them go wherever seabirds nest. Some seabird colonies are still empty after foxes, another introduced predator, were dropped onto seabird islands before the 1930s by people hoping to make money from later trapping the foxes for their fur.

Many traditional societies adopted rituals, rules, and accepted behavior to ensure that their required resources would always be available. Today we have habitat protection laws, hunting and fishing regulations, and predator control programs to prevent habitat destruction and over-exploitation of wildlife. One of our **habitat requirements** is to see that wildlife continues to thrive.

MATERIALS:

- cards labeled "food" and "water" (one each per student plus a few extra)
- bases for shelter/nesting areas (tape Xs on the floor, carpet squares, or paper plates)
- optional: tags or vests to differentiate players

PROCEDURE:

1. Place "food" markers on one side of the room or yard and place "water" markers on the other. Scatter several bases around the playing area which will serve as shelter (nesting areas) for students to stand on. Designate a few of these as predator shelter.
2. Explain that for any animal (including birds and fish) to survive, it must have food, water, and shelter (a place to hide). The object of the game is to get a food and a water marker and reach shelter before being caught by a predator. Predators get food by tagging a prey. Predators must get a water marker, tag a prey and return to the predator shelter bases. Only one person may be on a base at a time. If a prey does not have food and water, he may only stand on a shelter for the count of 10. If a prey has food and water, she may displace a thirsty or hungry prey player with only one marker (food or water). Predators cannot touch prey players when they are on a shelter base.
3. Select a few students to be predators. The rest will be prey. Possible predator/prey examples to use are foxes/kittiwakes or puffins/pollock. Start the prey on one side of the room or yard and the predators on

the other. After saying 'start', play for 3-5 minutes.

4. At the end of the round, stop activity and discuss what happened. Explain that for seabirds, especially in winter, the open ocean serves as "shelter." Those prey who obtained food, water, and shelter survived. Those prey who did not survive become predators. Original predators become prey.

5. Play more rounds, adding variations. Possibilities include varying the distance between shelter spots, limiting the number of food or water markers or players, or changing the ratio of predators to prey. Students will learn the importance of the arrangement of habitat components and that the resource in shortest supply (food, water or shelter) will limit the number of animals that survive (limiting factor).

6. After students have played the game with varying numbers of predators, food, water, and shelter markers, introduce a new type of predator - a "super-predator" - representing rats or foxes. Rats can catch prey even if they are on shelter markers and they can catch as many as they wish. They can also catch predators. Anyone caught by a rat is out of the game. The game is over when there is no more prey. What happens when rats (or other "super-predators") are introduced to a seabird colony? How can we prevent rats from ever reaching our seabird colonies? (See "Can Do!", to implement your students' ideas in your community.)

EXTENSIONS:

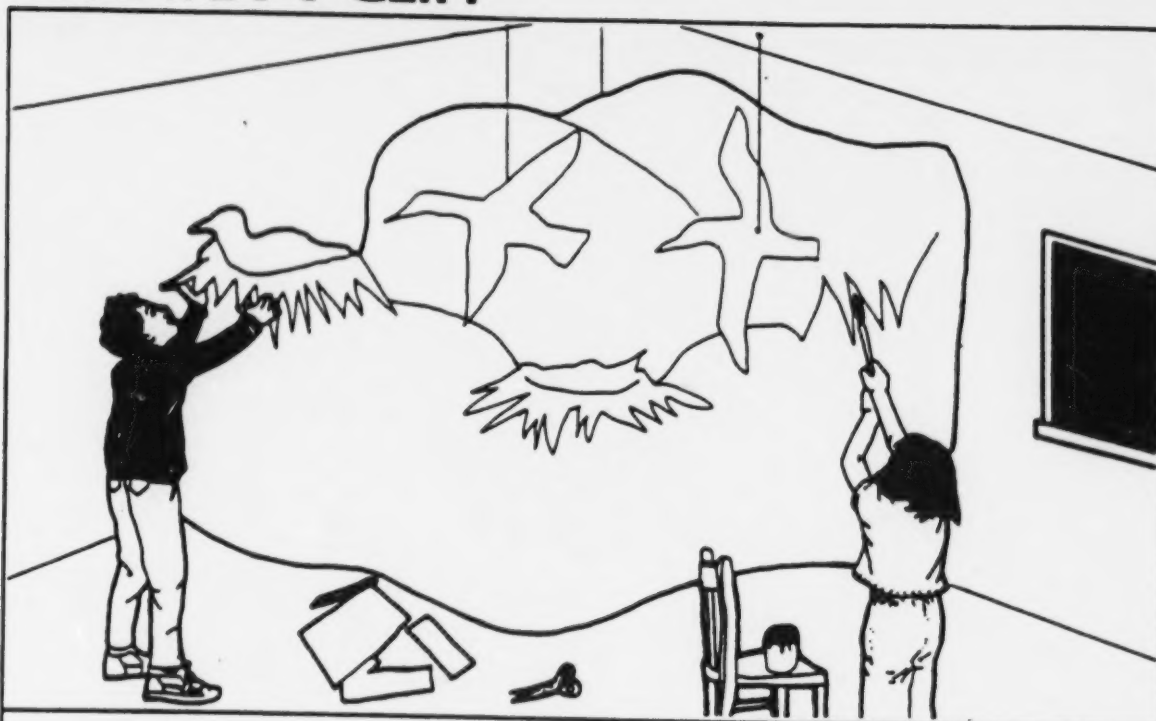
Introduce a new twist - humans. Humans can catch predators or prey, and they may catch as many as they wish. Anyone caught by a human is out of the game. The game is over when there is no more prey. What happens when humans catch too many prey or predators? In what other ways do humans harm seabird habitat? (Oil spills, plastic trash and other pollution, overfishing, etc.) Ask the students how they could keep the game going and still have humans. They

may make new rules, perhaps limiting the number of predator or prey players they can catch. They might limit the amount of time the human players can play, perhaps to 30 seconds per round. This simulates creating habitat protection laws, and hunting and fishing regulations and quotas. These regulations are designed to ensure that humans don't destroy too much habitat or take too many animals. Traditional cultures also

maintain rules that protect wildlife resources, for example, collecting seabird eggs only early in the season so the birds can re-lay successfully. Do any such rules exist in your community? What kinds of rules could be made to protect seabirds?

Adapted from: *Alaska Wildlife Week 1983*,
Alaska Department of Fish and Game.

CREATE A CLIFF



OBJECTIVE:

Students will apply knowledge of seabirds and their nesting habitats to create a model of a seabird colony.

BACKGROUND:

Think like a seabird. Where would you choose to lay your egg? This art activity turns the concept of a seabird colony into a tactile learning experience by actually building one in the classroom. This indoor activity can be conducted over several days. Some students may only know seabird cliffs from photographs. Many coastal Alaskan students, however, may have seabird communities for neighbors. Building a cliff takes both kinds of students into the close up living arrangements that allow a dozen different kinds of seabirds to live together in this premium space.

Seabird colonies are complex and dynamic. Each species occupies a specific **niche** in the community. Where a bird nests in the colony helps to identify it and tells important facts about its life. A diagram of a typi-

cal seabird community with all its "neighborhoods" can be found in the Teacher's Background Story and the red booklet, *A Guide to Alaskan Seabirds*. The accompanying poster also illustrates colony arrangements.

Some seabirds make a **nest** to keep their eggs safe and warm. Kittiwakes and cormorants build a nest of sticks, grass, and mud. But some seabirds, such as gulls and murre, lay their eggs right on the **bare ground**. Others go inside the cliff to lay their eggs in the soil of **burrows** (tufted puffins) or in **rock crevices** (guillemots, horned puffins, auklets). When building your model colony, pay special attention to creating distinct niches for each species represented.

Some seabirds can raise a family of several chicks each year. Gulls and cormorants often lay three eggs. But many seabirds can lay just one egg each year — murre, puffins, and auklets, for example. (Sometimes

a murre can lay another egg if a person or predator takes the first egg right after it is laid.) The small size of seabird families means that it is very important to do all we can to help the birds raise most of their young each year. See the activity "Can Do!" for ideas.

MATERIALS:

- bulletin board paper
- paints
- markers
- glue
- string
- paper mache
- reference material such as *A Guide to Alaskan Seabirds*, U.S. Fish and Wildlife Service, *Zoobooks - Seabirds*, and others listed in the Teacher's Background Story.

PROCEDURE:

1. As a group look at pictures of seabird colonies. Examine the individual features of the colonies. Where do each of the bird species nest? What is that section of the colony like?
2. Assign groups of children to research and build models of individual species of birds, such as puffins, murres and kittiwakes. Create a plan with your students for

how to build the cliff structure. Possible materials to be used include fishing net, chicken wire, chairs, desks, bulletin board paper, paper mache, etc. Encourage plans which have the cliff possess three dimensions. Some assistance may be needed to provide the infrastructure to support the cliff. Allow children to build models or paper cut-outs of birds. Encourage the production of enough birds to mimic an actual bird colony.

EXTENSIONS:

1. Visit an actual bird colony and talk about features of the colony not present in your model. These will undoubtedly include smell, noise, and guano. Which of these features could reasonably be included in the classroom model? Are you able to record the sounds of the bird colony on your visit? Note the differences between nesting habits of different species. Who nests where and why?
2. Several special seabirds found in Alaska won't be found on a cliff. Research which ones, and learn about their special nesting habitats.
3. Watch the video *Chain of Life*, available on loan from Alaska Maritime National Wildlife Refuge, 2355 Kachemak Bay Drive, Homer AK 99603, (907)235-6961.

FOXES AND KITTIWAKES



OBJECTIVE:

Students will gain an understanding of seabird **predator/prey relationships**, population growth and limits, and the utility of colonization through a highly interactive, capture-the-flag style game.

BACKGROUND:

While seabirds are on the ocean, they are the **predator** hunting for **prey** (small fishes and other tiny marine life) to eat or to carry back to feed their chick. When seabirds come onto land, they cease being predators and become potential prey for land animals such as foxes and rats, and birds that hunt other birds — falcons, jaegers, ravens, eagles, and some gulls.

How can seabirds protect themselves? One **adaptation** is to nest in huge communities with thousands of other seabirds so a hungry predator might eat all it wants long before reaching your nest. All those neighbors set up an alarm too, so no predator can sneak into the colony and catch you off guard. Kittiwakes and gulls will even try

to attack the predator in flights of dive bombing or **mobbing**.

Another adaptation is to hide. Some seabirds nest underground in burrows or in cracks and crevices between rocks. Some choose nest sites on sheer rock cliffs, inaccessible to most predators. However, rats can go almost everywhere and foxes too have few barriers, making them both the most feared predators on seabirds.

MATERIALS:

- seabird eggs (crumpled newspaper, foam balls, or strips of cloth), one for each student
- strips of cloth to mark predators, about ten each of two different colors - one color (such as red) for juvenile predators, and another color (blue) for adult predators.

PROCEDURE:

1. Play in a gym or all-purpose room. Choose a local seabird (such as kittiwakes)

and a local predator of seabirds (such as foxes) to be represented in this activity. To begin, all students will be kittiwakes (or other seabird you have chosen). Pass out one egg to each student. You (the instructor) will be the adult fox (or other local predator). Place the fox markers at one location in the room which will be the fox den site.

2. Explain that the object of the game is for the kittiwakes to have more eggs than the fox at the end of a two minute round. The kittiwakes may lay their egg wherever they wish, but once their egg is laid it cannot be moved. The fox can take only unguarded eggs. The fox can also take kittiwakes by tagging them. Once a fox tags a kittiwake it must willingly go with the fox to the den. The fox must take the kittiwake to the den before returning to its nest site for the egg. The captured kittiwake now becomes a juvenile fox and puts on a red scarf. The juvenile fox can capture only unattended eggs. Once a juvenile fox captures four eggs it becomes an adult fox and puts on a blue scarf. It can now capture kittiwakes.

3. Kittiwakes have only limited defense. If four or more kittiwakes hold hands and encircle a fox, the fox must return to its den before hunting again. A fox may not touch the banded kittiwakes unless the number of kittiwakes holding hands becomes less than four. In that case a fox may only capture one kittiwake at a time.

4. Begin the game by telling the kittiwakes to go find a place to lay their egg using a broad sweep of your arm which suggests nesting throughout the gym.

5. At the end of the first two minute round count how many eggs were captured by the fox, and how many kittiwakes survived. (If the kittiwake nest sites were scattered,

most eggs and kittiwakes were probably easily taken.) Discuss the results. Was it easy for the fox to take eggs and kittiwakes? Why? How might the kittiwakes defend themselves better? Encourage the students to come up with strategies for defense and safety such as nesting closely together in a colony.

6. Play another round, allowing the kittiwakes to nest together in a colony. At the end of the round, discuss the differences between the two rounds. Were more kittiwakes and eggs able to survive? Discuss actual examples of colonial nesting in seabirds. What other nesting habits protect seabirds from predation? (Nesting on sheer cliffs, on islands, and in deep burrows.) What were the limits to fox population growth?

EXTENSIONS:

1. When on a field trip to a seabird colony, look for predators or signs of predators (scat, den sites, broken egg shells, parts of birds such as wings and feathers).

2. At a seabird colony, conduct a study on the rate of predation over a period of several days or weeks. Choose and mark with stakes a section along the edge of the colony or the top of the cliff 100 feet or so in length. At regular intervals (every day or once a week), collect all broken egg shells found in your study plot. If you notice another area near the colony where predators spend a lot of time (such as a roost of ravens or gulls, or a fox den), include this place in your study. Count and record the number of shells, and sort by size and color if desired. Can you determine the type of predator leaving egg shells in your plot? Look for clues such as fox scat, gull "pellets", black raven feathers, etc. Did the number of shells collected vary a lot during your study? Why?

MURRE EGG RELAY



OBJECTIVE:

Students will learn about the nesting habits of murre, the uniqueness of their eggs, and experience the challenges seabirds face in raising their young. The activity consists of two parts - making paper mache eggs, and an active relay game.

BACKGROUND:

The seabirds called murre must be students of daring and physics. Daring, because they each lay their one egg on an open rock ledge (or open ground if their island has no land mammal predators) and build no nest. Their egg could roll off the ledge and plunge to the rocks below except for its shape - and physics. Their large egg is shaped like a pear, narrow at one end and wide at the other. This causes the egg to roll in a tight circle, making it less likely to roll over the edge.

Murres incubate their egg by holding it on top of their feet and against their belly, under a loose fold of feathers and skin. While one parent feeds offshore, the other sits on the ledge, incubating the egg. Oc-

asionally the parents will switch roles, carefully passing the egg between them.

Murre eggs vary in color from a pale blue-green to dark turquoise with black spots. The color helps to camouflage any unguarded eggs from air-borne predators looking down at the cliffs. The pattern of black splotches varies on each egg and may help adults recognize their own egg.

MATERIALS:

- Items to make paper mache eggs:
 - small water balloons, one for each student
 - newspaper torn in strips
 - flour and water
 - several bowls
 - blue, green and black paint
 - paint brushes
- Goldfish crackers
- Paper plates, one for every two students

PROCEDURE:

This is a two part activity and will extend over several days.

Part 1: Making paper mache murre eggs

1. Blow up small water balloons to approximately the size of a large pear and tie off. Mix flour and water in a bowl to make a paste. Dip newspaper strips in paste. Use fingers to remove excess paste and press strip to balloon. Continue until balloon is completely covered. Apply 2-3 layers of strips. Allow to dry for 2-3 days.

2. When the eggs have dried, paint them. Mix blue and green to obtain a turquoise color for the background. Decorate with black dots. Allow the paint to dry for 1-2 days. While making the eggs, discuss the unique shape and coloration of murre eggs. Have the students try to roll their egg off the edge of the table.

Part 2: Relay game

1. In a gymnasium or other large room, divide the group into pairs. Each pair of "murre" parents will need one egg.

2. Line up the "murres" along one side of the room. This side of the room represents the cliff ledge. Opposite of each pair on the other side of the room place a paper plate with six goldfish crackers on it. There should be one plate for each pair. This represents the ocean offshore where the birds feed.

3. Begin with one member of each pair holding the egg on the top of their feet. Stress that the egg cannot touch the cold floor, so must stay on top of the feet, not just between them.

4. At the signal "Go!", the other member of each pair must run to the "feeding area", take one fish from his/her pair's plate and eat it, and return to the cliff.

5. Now the pair switches roles, and must carefully pass the egg from feet of one to the feet of the other, *without using their hands*. Once the egg is securely on the feet of the other partner, the feeding partner now goes to the "ocean" to get a fish. Play continues until the food is all gone.

6. In the next round, play the same as above, except have two players be "rats" (or other predators such as ravens or foxes). The "rats" move around the cliff area and look for unattended eggs. If an egg rolls off the feet of the murre, it can be snatched by a rat. The rats can use their hands to grab the eggs, but they cannot steal the eggs off the feet of the murre. The murres must hold the egg on top of their feet, and not allow it to rest on the cold ground. If a murre pair loses their egg, they are out of the game.

7. Play several more rounds, varying the number of rats.

8. For the final round, show the effects of low-flying aircraft on a bird colony. Have someone pretend to be an airplane, buzzing low over the cliff. As the airplane flies past the birds, it frightens all of the murres and they jump off the cliff and fly out to the ocean, leaving their eggs unguarded on the cliff. The murres must touch the far wall of the room before returning to the cliff ledge. The rats try to gather as many eggs as they can before the murres circle back and land again on the cliff ledge. Did any eggs survive? Discuss what might happen if this occurs over and over again during the nesting season.

EXTENSIONS:

1. Test how well the camouflage of your murre eggs works in the playground. Hide all of the eggs around the playground in plain view. Have the students pretend they are predators such as ravens, rats or foxes. Allow them 3 minutes to collect as many as they can find.

2. Put all of the eggs together on a "ledge" (or on the floor). Have the students try to find their own egg.

3. During a field trip to a seabird colony, observe murres. Look for eggs, or see if you can tell which birds have eggs or chicks. The poster illustrates a murre feeding its chick.

COMMUNITY INTERVIEWS



OBJECTIVE:

Students will be able to give examples of traditional knowledge or stories from their community related to seabirds, wildlife, or the environment.

BACKGROUND:

Your community members have knowledge about seabirds (or the coastal environment, or marine issues) that goes back generations and perhaps into prehistoric times. While working on the other activities in this packet, questions may arise that can only be answered by elders and adults outside of school. This activity can tap into your community's heritage and promote the sharing of information at another level.

In predominantly white communities the journalistic skills of interviewing spring out of the culture's ideals about knowledge acquisition. Pointed and direct questions such as "Who?", "What?", "Where?", "When?", "Why?", and "How?" are the tools that will solicit in-depth answers.

Many Native communities may find those same direct questions offensive or at least intrusive. These cultures have a strong tradition in a different style of learning based not on detailed questions, but on observation, guided practice, and story. The effectiveness of the interview for a Native student may lie in the student's ability to minimize the use of western journalistic skills, and apply the forms of inquiry traditionally respected in the community.

MATERIALS:

- paper for taking notes and/or tape recorders and tapes
- information about local laws and regulations affecting wildlife

PROCEDURE:

1. Start a discussion about a local topic that involves wildlife, hopefully seabirds. Are there different points of view in the community about this topic? Are there other topics that interest the students? List them.

2. Teach the western journalism skills. Get a large sheet of bulletin board paper and divide into three columns. In the first column write the six basic questions "Who?", "What?", "Where?", "When?", "Why?", and "How?". Label this column "Journalist's Questions." Select one of the discussion topics from above and generate specific questions. List these questions in the second column.

3. Ask the students how their grandmother or aunt would react to them coming over with a tape recorder and asking these direct questions. The point of this discussion is to see if the students can come to a consensus on what the community standards are regarding children asking direct questions. To help guide the discussion you might ask questions such as: "Would (name a younger adult in the community who is in a leadership position) feel comfortable answering these questions?" "What is the best way to get an older person to tell you a story?" "What is the respectful way to show you are interested and listening to an elder?" "If you still don't get the information you want or need, are there others (intermediaries) who could find out information for you?" Summarize student's responses in column three. State clearly that both ways of gaining information are valid. The goal is for them to be able to use both methods in the appropriate circumstances.

4. Before going out into the community, have the students "interview" each other for practice using the questions generated above. Have them write or tape record their responses so that they may be compared later with responses received from community members.

5. Next, ask the students, working alone or in groups, to interview at least one long-time resident of their community. The students should be prepared to take notes, or to tape the interviews. Instruct the students to be sure to take time to listen to any of the stories the people might tell that are slightly off the subject; out of courtesy, and also in recognition that the slightly diver-

gent topics will also be interesting and pertinent in some ways. Optional: interview other categories of people; e.g., family members, wildlife managers or researchers, members of the city council.

6. Compile the results of the interviews. This might be done in a time-consuming way, where the interviews are transcribed, analyzed, summarized, and discussed. Shorter approaches may also be taken: each group of students summarizes the results of its interviews in a one-page format, and then a small group of students volunteers to prepare a summary representing the findings of all the students.

7. Discuss the findings, including what different points of view were identified, and factors which might contribute to people having different points of view.

EXTENSIONS:

1. Identify a local controversial issue involving or affecting seabirds, wildlife or other natural resources. Find out the facts. What is the issue? How did it develop? What attitudes and information are involved? What possible solutions are available?

2. Start this activity by pretending you were living 100 or 200 years ago. What animals did you see? How did you live? Day to day, week to week, season to season? After imagining yourself at that time, discuss what your attitudes might have been toward natural resources and the environment. Might they be different today? In what ways?

3. Translate the names of birds in your area into the local Native language. Use the blank column in the chart of seabird names on the next page to record the bird names in your local dialect.

4. Make a class "newsmagazine" which compiles the student interviews and/or showcases students' seabird art.

Adapted from: *Teach About Geese*, U.S. Fish and Wildlife Service.

SEABIRD NAMES

ENGLISH	TLINGIT	ALUTIIQ	UNANGA ^â ALEUT	CENTRAL YUP'IK	INUPIAQ	SIBERIAN YUP'IK	put your dialect here
Northern Fulmar			Aaglu-â, Saayu-â			Aghqulluk	
Shearwaters			Aduya-â, Saquya-â			Kaputaghaq	
Storm-petrels	Ganook		Livdrilqa-â				
Double-crested Cormorant			Txax	Uyalegpak			
Pelagic Cormorant	Yook		Agayuuâ Kanullisigi-â	Agasuuq Uyalek	Pautuk	Ngelqaq	
Red-faced Cormorant			Ingatu-â				
Jaegers			Allgdusiâ, Kilyux	Yunaq	Isungngaq	Yuungaaghaaq	
Glaucous Gull				Naruyarpak	Nauyasasugruk	Naghuyapik	
Glaucous-winged Gull			Sluka-â	Naruyarpak	Nauyasasugruk	Ugraaq	
Herring Gull	Keltlyudee		Slukaada-â		Taglum nauyaq	Ugraaq	
Mew Gull				Naruyak	Nauyatchlaq		
Black-legged Kittiwake			Tilgigaada-â Gidaaâ	Arilaq, Naryacuaq Tengaurta		Qagsungliq	
Red-legged Kittiwake			Qagâya-â			Qagsungliq	
Bonaparte's Gull				Nacallingar			
Sabine's Gull				Nacallingar	Aqargiglaq	Nasallenguq	

SEABIRD NAMES

ENGLISH	TLINGIT	ALUTIIQ	UNANGAX ALEUT	CENTRAL YUP'IK	INUPIAQ	SIBERIAN YUP'IK	put your dialect here
Arctic Tern	Kichyat		Qiliqda-x̂	Teqiyaar	Mitqutallaq	Tekeylighaq	
Aleutian Tern							
Common Murre			Uluxtxa-x̂, Sakita-x̂	Alpaq	Alpa, Akpak	Kuwaag, Alpa	
Thick-billed Murre			Uluxtxa-x̂ Sakita-x̂	Alpaq		Aqevgaghnak Alpa	
Black Guillemot				Qayagpagayull	Sigvaq	Samseghhaghaq	
Pigeon Guillemot			Sihmku-x̂, Qachilda-x̂	Qayagpagayull		Samseghhaghaq	
Marbled and Kittlitz's Murrelets	Ch'eel, Keel			Cigur		Tagltuwlq	
Ancient Murrelet			Qidanga-x̂			Tagltuwlq	
Cassin's Auklet			Umaxchida-x̂				
Parakeet Auklet			Qihmuugda-x̂		Sayuguyuuq	Suklugraq	
Crested Auklet			Kunugyu-x̂			Suklipaq	
Least Auklet			Chuuchilx̂			Akmallighaq	
Whiskered Auklet			Kdlilx, Tuhmu-x̂				
Rhinoceros Auklet	Xik						
Horned Puffin	Xik		Qaglda-x̂	Quengacuar		Quprughaq	
Tufted Puffin	Logun		Uxchu-x̂	Qllangaq	Tunngaq	Pagrugaq	

NO WATER OFF A PUFFIN'S BACK



OBJECTIVE:

Students will be able to: 1) identify ways oil spills can affect seabirds adversely, and 2) describe possible negative consequences to wildlife, people, and the environment of human-caused pollutants.

BACKGROUND:

The impacts of environmental pollution often are difficult to see. A major oil spill, however, provides dramatic evidence of potential impact to wildlife, especially seabirds. Examples include damage to feathers, killing of embryos by poisoning when oil seeps into eggs, and death by ingesting food and water contaminated by oil.

People are involved in efforts to prevent oil spills and to "clean up" after spills take place. Such actions are well-intentioned but sometimes have consequences as well. For example, the process of using detergents to clean oil from the feathers of birds caught in spills may also damage the birds' feather structure and arrangement. The feathers thus cannot insulate and waterproof the birds adequately. Birds may get sick more easily because of stress and be-

come too weak to find food or clean their feathers. Obviously, the food and water sources of birds may also be affected by oil.

Oil spills are just one example of the kinds of pollutants that can have adverse short and long-term effects on wildlife, people, and the environment. The impact of DDT on the food chain is well-known, causing the thinning of egg shells in bald eagles and other birds. Habitat destruction, such as the logging of nesting habitat of murrelets, can combine with the effect of pollutants to threaten the existence of species.

The major purpose of this activity is for students to examine some of the possible consequences of human-caused pollution for seabirds.

MATERIALS:

- cooking oil
- shallow containers, 1 for each group of 3-4 students
- small bowls, 1 for each group

- eye droppers
- hand lenses, at least 1 for each group
- feathers, at least 1 for each group
- dishwashing liquid or other liquid detergent
- hard-boiled eggs, 3 for each group

PROCEDURE:

1. Divide the class into groups of three or four. Each group needs a shallow pan partially filled with water. Add a known amount of oil to the pan, one drop to one dropper full, depending on the size of the container. Observe the interaction of oil and water. Measure the area covered by the oil. Using this information, estimate the area that might be affected by an oil spill involving:

- 1) A tanker truck holding 8,000 gallons.
- 2) A ship holding 300,000 gallons.
- 3) A supertanker holding 83,000,000 gallons.

Conversion factors you may need:

- 76 drops = 1 teaspoon
- 768 teaspoons = 1 gallon
- 1296 square inches = 1 square yard
- 4840 square yards = 1 acre
- 640 acres = 1 square mile

Discuss and compare estimates with other groups. Graph estimates and compute average figures.

2. Put enough oil in a small container to submerge three hard-boiled eggs. Add the eggs. Put the eggs under a good light and watch closely. Remove one egg after five minutes and examine it - before, during, and after peeling off the shell. Try to remove the excess oil from the outside before attempting to peel the egg. Remove the second egg after 15 minutes and the third egg after 30 minutes, repeating the procedure, examining each carefully. Discuss observations. What effect could oil have on the eggs of birds nesting near the water?

3. Examine a feather with a hand lens. Sketch what you see. Dip the feather in water for one or two minutes, and examine again with a hand lens. Sketch and compare to the original observations. Place the feather in oil for one or two minutes, and then examine with a hand lens, sketch, and compare with other sketches. Clean the feather in detergent, rinse in water, and dry it. Examine with a hand lens, sketch, and compare with previous sketches. Discuss changes in the feather after exposure to oil and then to detergents. What effect could these changes have on normal bird activity?

4. Discuss other possible effects on birds from an oil spill. Discuss possible impacts on other wildlife species, on humans, and on the environment. What trade-offs are involved? Do we have to choose between oil and birds, as well as other wildlife? What are some alternatives? What are other examples of human-caused pollutants that can have negative consequences for wildlife, people, and the environment? What is being done or can be done about these as well?

5. Optional: Ask each student to write a report, summarizing the findings of the experiment as well as making recommendations.

EXTENSIONS:

1. A variety of oils - cooking oil, clean motor oil, baby oil - could be used, with effects compared. Be sure to dispose of these items properly.

2. Other pollutants can be used to see what, if any, effects they have on eggs and feathers. Exercise caution, however: do not use any unusually dangerous substances.

Adapted from: *Project Wild*, Western Regional Environmental Education Council.

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FEEDING FRENZY



OBJECTIVE:

Students will see how easily seabirds and other animals can mistake plastic for food, and how concentration and proximity of food resources affects feeding success.

BACKGROUND:

Think about the variety of plastic litter and packing material you've seen along the ocean shore: food containers, foam cups and coolers, six-pack rings, fishing line and corks. When these items are carelessly tossed into the ocean or blow from a shoreside garbage dump, they become a hazard to marine life.

The plastics eventually are broken into smaller pieces and concentrate in the same currents and tide rips where fish and other marine prey can be found. Seabirds seeking a meal in that concentration of prey may swallow some plastic trash, mistaking it for food in their rush to catch as much as possible before the school of fish or swarm of zooplankton moves out of reach. Seabirds cannot digest the plastic, so it builds up in their stomach, taking the place of real food. The birds slowly starve.

Seabirds may also starve or drown if they become entangled in fishing line, nets, or plastic six-pack rings. They have no way to escape from such trash. Even a six-pack ring or fishing line on the beach is a threat to them because it will soon be blown into the ocean or may trap birds if they come ashore to rest.

Human fishing activities, pollution, and natural lows in a prey species cycle may cause seabird food sources to be in short supply. Seabird chicks will be the first to starve if their parents must fly too far from nesting areas for the right kinds of fish or zooplankton. Seabirds may be forced to abandon their nests in such a bad year. Sometimes even the adult birds will starve.

MATERIALS:

- trays or shoe boxes (1 for every 4 students)
- plastic foam packing pellets, 1/2 cup for each tray
- popcorn, 1 1/2 cups for each tray
- a spoon and cup (clear plastic, if possible) for each student

PROCEDURE:

1. The object of the game is to collect as much food as possible in the time allotted. In each tray, mix plastic pieces with popcorn. Do not tell the students that the plastic pieces are not food. Give each student a "stomach" (cup) and a "beak" (spoon) and place them in groups of four around each tray.

2. Explain that the birds must pick up their food using only their beaks and put it into their stomachs. Food may not be scooped or thrown into the stomach.

3. Allow the birds to feed for 30 seconds. When time is up, all feeding must stop. Have each bird count and record the total number of pieces of popcorn and plastic eaten. Explain that the plastic pieces cannot be digested, so that any birds having mostly plastic in their stomachs would be starving. Return the popcorn to the feeding trays, but have each bird keep the plastic it collected in its stomach to simulate how plastic accumulates and is not digested.

4. Play several more rounds to illustrate how the plastic accumulates. Tally the popcorn and plastic pieces after each round. Some birds may eventually have stomachs filled entirely with plastic. Explain that these birds would not survive.

5. For an additional round, play in a gym or large room if possible. To represent a year in which food resources are located a long distance from the nesting area, place the food trays at one end of the room and have the students line up in pairs on the other side of the room. Again, allow only 30 seconds for feeding, but this time the students must run to their food tray. Only one bird in each pair may feed, because the other must stay on the nest to incubate eggs. The feeding bird must share its catch with its partner. At the end of feeding time,

again have each bird count and total the number of pieces of food and plastic. Compare with the results of the previous round.

6. For another additional round, scatter the contents of half of the trays around the room. Explain that the food in the other trays is no longer available because it was taken by other animals or people, or was killed because of pollution. Again, allow all the birds to feed for 30 seconds. Again, count the number of pieces obtained. Was it harder to get enough food when it was scattered around?

EXTENSIONS:

1. Birds may also become entangled in plastic trash, especially fishing nets and 6-pack rings. To simulate this, for one round tie the arms of a few students to their bodies at the elbows so that it is more difficult to feed.

2. Watch the video *Trashing the Oceans*, available on loan from U.S. Fish & Wildlife Service, Resource Support, 1011 E. Tudor Road, Anchorage AK 99503, phone (907) 786-3351. This video and other information on marine debris may also be purchased from NOAA's Marine Debris Information Office in San Francisco, California. An order form is included at the back of the curriculum.

3. Conduct a beach cleanup and record the different types of trash collected. How might these items harm seabirds and other wildlife?

4. Encourage your students to cut up 6-pack rings before throwing them in the trash. This will prevent birds or other animals from becoming entangled in them at the dump.

Adapted from: *Ripples: A Big Sweep Elementary Activity Guide*, North Carolina Wildlife Resources Commission, 1990.

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CAN Do!



OBJECTIVE:

Students will: 1) identify a problem involving seabirds, 2) suggest and evaluate alternative means to either solve the problem or improve the situation, 3) undertake the project to solve the problem, and 4) analyze and describe the process by which they successfully solved the problem or improved the situation.

BACKGROUND:

This activity is designed for students to identify a local situation in which they can help seabirds. The situation can either involve actual "hands on" experience, like a beach clean-up, or it may involve a political action project in which the students learn how to influence people in authority to carry out a desirable action for wildlife.

Each of us can make constructive contributions to improving the environment in which we live. Sometimes our actions can improve the environment for people, sometimes for wildlife, and sometimes for both. Sometimes we can get more done if we work with other people sharing ideas, information, and skills. A working knowledge

of the following terms will be useful to students in this activity:

Problem: a difficult situation to be improved, or an opportunity to make things better. Problems cannot always be "solved", but situations usually can be improved.

Authority: an individual or group of people with the power to make changes.

Compromise: a way to settle a problem in which both "sides" usually give a little.

Given that it is important for young people to learn that they "can do" for people, wildlife, and the environment, use your judgement in the course of this activity to assist students in selecting a project that is realistic, constructive, and possible. If not, the students may experience an activity that contributes to their thinking that they "can't do." The major purpose of this activity is to provide students an opportunity to experience success in taking constructive actions to improve the environment for people and seabirds.

MATERIALS:

- writing materials

PROCEDURE:

1. Ask the students to think of some ways to improve local areas as homes for seabirds. They might generate a list of activities in their community that have a negative impact on birds. The list might include: litter that poses a hazard for birds (fishing line, fish nets, six pack rings); the possible introduction of rats from ships or boats; disturbance from humans, dogs, feral cats, or low-flying aircraft; catching birds in local fishing nets; pollution of streams or the sea; need for information on local birds; etc.
2. Look at the list of possible bird habitat problems and the suggestions for ways to improve bird habitat. Ask the students to select one they think they could realistically do something constructive about in a realistic amount of time. If they have difficulty deciding, and reasonable support has been offered for each, the students might vote to decide. Students could also make speeches in support of the problem they want to tackle, in hopes of swaying the class vote.
3. Once the problem has been selected, ask the students to work alone or in small groups to begin to generate ideas for possible solutions to the problem and ways to implement the project. Each individual or small group could come up with a plan, including written descriptions and sketches illustrating how to accomplish the project, step by step.
4. Ask the groups to present their plans to the rest of the students. Students may ask questions of the group. Once all the plans have been presented, ask the students to select the plan that seems most: a) constructive, b) realistic, c) helpful to birds, and d) likely to make a lasting contribution.
5. Ask the students to select one or more alternative plans, in case their first choice is not acceptable to authorities at the school or village.

6. Once a plan (with alternatives for "back-up") has been selected, ask the students to select a delegation to present their proposal to the school principal or the appropriate authority. Remember to include janitors, grounds keepers, school board, etc. (anyone who would be physically and/or officially involved). A practice session before the students and any interested parents or other groups of students would be helpful. At the practice session, the student delegation would make their presentation as they plan to do before the principal (janitor, council, etc.), responding to any questions from their audience that might be raised.

7. The students should make an appointment to present their proposal, make the presentation, and report back to their classmates. If their plan is accepted, they should make sure they know whom to contact next in order to successfully complete their project.

8. Making sure they have all necessary permissions secured, the students should proceed to successfully accomplish their project.

9. Once accomplished, ask the students to analyze their results. Did things work out the way the students wanted them to? Were there any surprises? Any unforeseen problems? How might they have been any more effective?

Possible Community Projects Related To Seabirds

- Start a "Trashbusters" program. Conduct beach clean-ups and anti-litter campaigns.
- Research existing rat control programs in the community. Develop ways to assist and/or improve the programs.
- Design a better rat trap for use on mooring lines. Current traps work well keeping rats from moving from shore onto boats, but not vice versa (the rats simply jump off the line and swim ashore).

- Gather data during different seasons on which species migrate through your area, which breed there, and if any spend the winter there. Have students provide observations about the dates different bird species are first sighted each spring, the date certain plants are first observed turning green or flowering, the date the first eggs are observed of the different species, etc. This information can be compiled over several years, average dates calculated, and changes plotted on graphs and compared.

The data you collect can be useful to the U.S. Fish and Wildlife Service! If you would like to contribute your data to the Alaska Seabird Colony Catalog database, please contact Dr. Vivian Mendenhall before you begin, at Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, phone (907)786-3517. She will help you set up your project.

- Develop a seabird calendar. Interview people in the community or make observations to find out when the different species return and leave, when they nest, etc.

- Develop a map of good local birdwatching areas and the types of birds that can be found there at different seasons.

- Develop an information program for the community about seabirds and any problems facing them: leaflets, posters, videotapes, newspaper articles, displays at local events.

- Produce a classroom newspaper with articles about marine life and seabirds.

- Write a letter or article for the local newspaper, and try to get it published.

- Research water use in your community. Where does it come from? Where does it go? How is it used? Are things added to it or to sewage before discharging it back into water? Where is pollution occurring? Have students make personal, household and community inventories of water use and brainstorm ways to reduce use and pollution.

- Survey the community about the abundance of seabirds in local areas, and their use of the birds. Be sure to include older people and Native elders to determine how the areas and use has changed over their lifetime.

EXTENSIONS:

Document the entire process on video tape.

Adapted from: *Teach About Geese*, U.S. Fish and Wildlife Service.

GLOSSARY

adaptation: an adjustment to environmental conditions: any modification of a plant or animal that helps it survive.

colonies: closely packed groups of nesting seabirds.

decomposers: organisms (such as bacteria or fungi) that break down dead plants and animal materials and return nutrients to the system: recycling!

diatom: single-celled algae with a hard shell.

dinoflagellate: tiny marine plant, so small you can't see it without a microscope. A kind of phytoplankton.

ecosystem: a community of living things plus the physical and chemical environment with which they interact.

food chain: who eats what in the natural world. Sequence of living organisms in a community in which one level feeds on those in the level below it, and in turn are eaten by those in the level above them.

food web: all the interacting food chains in an ecological community.

habitat: where a plant or animal lives and the things it needs there to survive.

krill: a kind of zooplankton — tiny shrimp about as big as your fingernail.

limiting factor: something (such as food, disease, or predation) that limits the number of animals or plants that survive.

middens: ancient (archaeological) garbage dumps.

mobbing: when birds gang up to fly at and dive bomb a predator.

niche: an animal's or plant's specialty in life.

pelagic: living on the ocean, far offshore.

phytoplankton: tiny plants that live in water and drift with the currents.

predator: an animal that captures and eats other animals for food.

prey: animals that are killed and eaten by other animals.

primary consumers: animals that eat plants.

primary producers: plants: they use solar energy to convert nonliving substances (water, air, soil) into food.

salt gland: an adaptation inside seabirds for safely drinking seawater.

secondary consumers: animals that eat other animals which eat plants.

tertiary consumers: animals that eat animals which eat animals.

zooplankton: tiny animals that live in water and drift with the currents.

FOR MORE INFORMATION...

The federal agencies below manage public lands containing seabird habitat. Contact them for more information about your area, or for assistance in planning field trips.

U.S. FISH & WILDLIFE SERVICE

Migratory Bird Management
Dr. Vivian Mendenhall
1011 E. Tudor Road
Anchorage, AK 99503
Phone: (907) 786-3517

Contact the refuges for local assistance

Alaska Maritime National
Wildlife Refuge
Poppy Benson
2355 Kachemak Bay Dr., Suite 101
Homer, AK 99603-8021
Phone: (907) 235-6546

Alaska Peninsula/Becharof National
Wildlife Refuge
Angie Terrell-Wagner
P.O. Box 277
King Salmon, AK 99613
Phone: (907) 246-3339

This office coordinates and conducts seabird studies around the state, and maintains a computer database on Alaska seabird colonies. They can provide you with maps and population data for most colonies in your area. You can help keep the database up-to-date by counting birds in your area. If you would like to set up a bird counting project, contact Dr. Mendenhall.

Arctic National Wildlife Refuge
Tom Edgerton
101 12th Avenue, Box 20
Fairbanks, AK 99701
Phone: (907) 456-0250

Izembek National Wildlife Refuge
Susan Schumacher
P.O. Box 127
Cold Bay, AK 99571
Phone: (907) 532-2445

Kodiak National Wildlife Refuge
Diana Brooks
1390 Suskun River Road
Kodiak, AK 99615
Phone: (907) 487-2600

Selawik National Wildlife Refuge
Janet Warburton
P.O. Box 270
Kotzebue, AK 99752
Phone: (907) 442-3799

Togiak National Wildlife Refuge
Carol Wilson
P.O. Box 270
Dillingham, AK 99576
Phone: (907) 842-1063

Yukon Delta National Wildlife Refuge
Lorne Beck
P.O. Box 346
Bethel, AK 99559
Phone: (907) 543-3151

NATIONAL PARK SERVICE

Cape Krusenstern National Monument
Bradley Shultz
P.O. Box 1029
Kotzebue, AK 99752
Phone: (907) 442-3890

Glacier Bay National Park and Preserve
Chief of Interpretation
P.O. Box 104
Gustavus, AK 99826
Phone: (907) 697-2230

Katmai National Park and Preserve
Susan Savage
P.O. Box 7
King Salmon, AK 99613
Phone: (907) 246-3305

Kenai Fjords National Park
Jim Pfeifferberger
P.O. Box 1727
Seward, AK 99664
Phone: (907) 224-3175

Wrangell-St. Elias National Park
Marge Steigerwald
P.O. Box 29
Glennallen, AK 99588
Phone: (907) 822-5234



U.S. FOREST SERVICE

Chugach National Forest
Anchorage Headquarters
3301 C St., Suite 300
Anchorage, AK 99503-3998
Phone: (907) 271-2500
Direct inquiries to a specialist of interest,
such as a wildlife biologist or plant ecologist.

Chugach National Forest
Cordova Ranger District
Sandy Frost/Mary Anne Bishop
P.O. Box 280, 612 2nd Street
Cordova, AK 99574
Phone: (907) 424-7661

Chugach National Forest
Glacier Ranger District
Jo Ellen Lottsfeldt
P.O. Box 129
Girdwood, AK 99587
Phone: (907) 783-3242

Chugach National Forest
Seward Ranger District
Bill Shuster
P.O. Box 390
Seward, AK 99664
Phone: (907) 224-3374

Misty Fjords National
Monument/Wilderness
Jackie Canterbury
3031 Tongass Avenue
Ketchikan, AK 99901
Phone: (907) 225-2148

U.S. Forest Service
Alaska Region
Mackay McClung
P.O. Box 21628
Juneau, AK 99802
Phone: (907) 586-7904

FOR MORE INFORMATION...

The following books are recommended for further reading and as field trip aids. Several are available by mail order from the Alaska Natural History Association as noted. An order form is included at the back of the curriculum.

FIELD GUIDES

Familiar Birds of Sea and Shore by Simon Perkins (National Audubon Society/Random House, 1994). A pocket-size guide describing selected seabirds, shorebirds and waterfowl, with photographs and range maps. 191 pp. ISBN 0-679-74921-7

Field Guide to the Birds of North America from National Geographic. An excellent field guide with descriptions, range maps and full-color illustrations of both seabirds and landbirds. 464 pp. Available from the Alaska Natural History Association. ISBN 0-87044-692-4

A Guide to Alaskan Seabirds (U.S. Fish and Wildlife Service/Alaska Natural History Association). A 44-page booklet with illustrations, range maps and habitat information for seabirds found in Alaska. A copy is included with this curriculum. Additional copies can be ordered from the Alaska Natural History Association. ISBN 0-9602876-4-7

Guide to the Birds of Alaska by Robert H. Armstrong (Alaska Northwest Publishing Company, Anchorage, 1995). Another good field guide with photographs and Alaska distribution information. 342 pp. Available from the Alaska Natural History Association. ISBN 0-88240-462-8

A Guide to the Natural History of the Birds of St. Lawrence Island, Alaska by Paul R. Ehrlich et al. (Center for Conservation Biology, Stanford University, 1993). A 28-page booklet with descriptions of each species found on St. Lawrence Island, including Yupik names.

Ocean Birds of the Nearshore Pacific: A Guide for the Seagoing Naturalist by Rich Stallcup (Point Reyes Bird Observatory, Stinson Beach, California, 1990). Detailed descriptions of 80 seabirds, plus other marine animals. Includes behavioral information and photographs. 214 pp. ISBN 0-962591-807

Seabirds, An Identification Guide by Peter Harrison (Houghton Mifflin Company, Boston, 1985). The definitive guide to seabirds. Includes range maps, color plates and detailed descriptions of each species worldwide. 448 pp. ISBN 0-395-60291-2

REFERENCE BOOKS

Atkam Sangis, Atkan Birds by Moses Dirks (University of Alaska, Materials Development Center). A description of birds found on Atka Island, in both Unangax Aleut and English. 78 pp.

Seabirds by Paul Sterry (Raintree Steck-Vaughn, Austin, Texas, 1994). A visual exploration of seabird adaptations, written for 4th-5th graders. 32 pp. ISBN 0-811-461882

Seabirds by John P.S. Mackenzie (NorthWord, Ashland, Wisconsin, 1987). Beautiful photographs with general descriptions of the families. 142 pp. ISBN 0-942802-52-7

Seabirds of Eastern North Pacific and Arctic Waters edited by Delphine Haley (Pacific Search Press, Seattle, 1984). A well-illustrated and interesting account of the birds of this region, with photographs and range maps. 214 pp. ISBN 0-914718-86-X

Seabirds of the World by Eric Hosking (Facts on File, New York, 1984). An in-depth discussion of the seabird families of the world, with photos. 159 pp. ISBN 0-87196-249-7

Zoobooks Seabirds. A colorful and informative booklet, included with this curriculum. Additional copies can be ordered from the Alaska Natural History Association. ISBN 0-937934-66-6

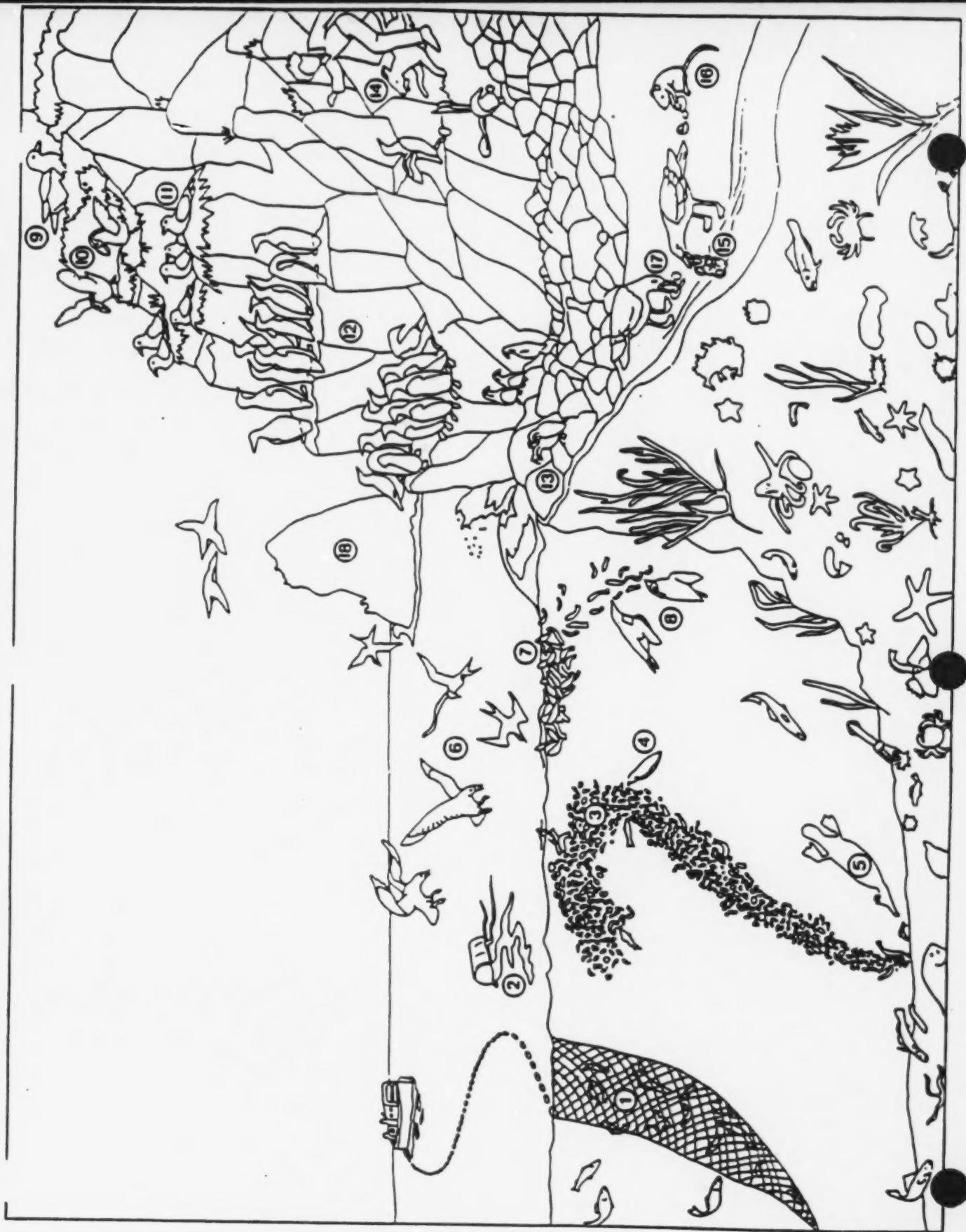
CHILDREN'S STORIES

Nights of the Pufflings by Bruce McMillan (Houghton Mifflin, New York, 1995). A charming story about children in Iceland who rescue young puffin chicks stranded in their village. 32 pp. ISBN 0-395-70810-9

Puffin, A Journey Home by Jim Tilly (Misty Mountain Publishing, Eagle River, Alaska, 1993). Written and published in Alaska, a beautifully illustrated story explaining why puffins are so brightly colored. 32 pp. ISBN 0-9635083-4-2

Puffin by Naomi Lewis (Lothrop, Lee and Shepard Books, New York, 1984, ISBN 0-688-03783-6) and **The Puffins Are Back!** by Gail Gibbons (Harper Collins Publishers, 1991, ISBN 0-06-021603-4). Two delightful stories about the lives of Common Puffins on the Atlantic Coast.

Where Are My Puffins, Whales, and Seals? by Ron Hirschi (National Audubon Society/Bantam Books, New York, 1992). A photographic journey along the coast, with a conservation message. 44 pp. ISBN 0-553-0783-8



POSTER KEY

HELP PROTECT ALASKA'S SEABIRDS

1 Gill Net: Fish are being caught in this gill net. If people catch too many fish, birds cannot find enough food for themselves and their chicks. The net has also caught birds. The birds will drown.

2 Barrel: This barrel is leaking oil. Oil ruins the feathers of seabirds so they die of cold.

3 Plankton: Plankton are tiny plants and animals living in the seawater. Many fish eat plankton, and so do some birds.

4 Auklet: Auklets are small seabirds that eat plankton, which they chase while swimming underwater.

5 Cormorant: Cormorants feed near the bottom of the sea. They swim with their feet.

6 Kittiwakes and terns fishing: Kittiwakes and terns fly down and catch fish at the surface of the water. These birds cannot dive below the surface, so they need schools of fish that come to the surface where the birds can reach them.

7 School of fish: Some kinds of fish swim in very dense groups (schools). These schools are important for seabirds because the birds can catch the fish easily in schools.

8 Murre and puffin fishing: Murres and puffins catch fish by chasing them underwater. These birds swim underwater with their wings.

9 Gull nest: Gulls nest on gentle slopes. They sometimes eat eggs or chicks of other seabirds.

10 Puffin colony: Tufted puffins usually make their nests in burrows underground, where each female bird lays one egg.

11 Kittiwake colony: Kittiwakes build nests on the cliffs and lay one or two eggs (or sometimes three, if they have plenty of food).

12 Murre colony: Murres nest on narrow ledges. Each female bird lays one egg on the bare rock. Murres nest very close together for protection from predatory birds like gulls. One murre is feeding a chick.

13 Auklet colony: Auklets nest in crevices under rocks. Each female bird lays one egg.

14 Disturbance: People can hurt seabirds by making loud noises or moving fast near the colonies. If parent birds are scared from their nests, their eggs or chicks may be hurt or killed.

15 Plastic on the beach: This six-pack ring and other plastic trash can injure seabirds.

16 Rat: Rats can run or swim off boats and move into seabird colonies. Rats kill many small birds and eat eggs. They are very dangerous to seabirds.

17 Gull eating egg: The gull is eating an egg which it stole from the murres or kittiwakes. Gulls are seabirds, but they also are predators on other birds.

18 Seabird colony: Many seabirds nest together in large colonies.

SLIDE SHOW

LEARN ABOUT SEABIRDS

(All photographs were taken in Alaska, except slides 19, 28 and 29)

<u>Title on Slide</u>	<u>Long Description</u>
1 Common murres with eggs (Could be anywhere in Alaska)	These common murres are incubating eggs which they laid on the bare rock ledge. One murre egg is lying to the left of the birds. If a gull sees this egg before the parent returns to protect it, the gull will eat the egg.
2 Thick-billed murre with chick (Pribilof Islands, Bering Sea)	This thick-billed murre is standing on a ledge with its downy chick. When the sun is not shining it will brood the chick with its body to keep it warm.
3 Black-legged kittiwake on nest (Buldir Island, Aleutians)	This black-legged kittiwake is standing on the edge of its nest. There are two eggs in the nest.
4 Glaucous-winged gull (Could be anywhere in Alaska south of Norton Sound)	This glaucous-winged gull is a seabird that sometimes preys on (eats) the eggs or chicks of other seabirds.
5 Horned puffins (Cape Thompson, south of Point Hope, Chukchi Sea)	These three horned puffins are sitting near their nest crevices in the cliff.
6 Tufted puffin (Could be anywhere in Alaska)	The tufted puffin sometimes nests in crevices in the cliff, sometimes in burrows which it digs in the ground.
7 Crested auklets (Could be anywhere from lower Alaska Peninsula islands to Aleutians, Bering Sea or Diomed Islands)	These crested auklets are named for the long curved feathers that grow out of their heads.
8 Least auklet (Could be anywhere from lower Alaska Peninsula islands to Aleutians, Bering Sea or Diomed Islands)	This least auklet weighs only 3 ounces and is Alaska's smallest seabird.
9 Double-crested cormorant (Probably Lake Louise, near Glenallen)	The double-crested cormorant, like all cormorants, has a pouch of colored skin at its throat.
10 Common murres in colony (St. Paul Island, Pribilofs, Bering Sea)	These common murres are standing on the cliff ledge where they will lay their eggs. Murres always try to nest very close to other murres, which helps protect their eggs from predators.

	<u>Title on Slide</u>	<u>Long Description</u>
11	Common murre colony (Square Rock, near Bluff, Norton Sound)	These common murres are nesting all over the top of the rock island, and also on ledges on the side of the island.
12	Murres, kittiwakes, puffins, and gull in a colony (Puffin Island, Kotzebue Sound)	Common murres, thick-billed murres, black-legged kittiwakes, horned puffins, and a glaucous gull are nesting together in one colony. Murres and kittiwakes are close together on ledges. Some kittiwake nests have chicks in them. The horned puffins are standing near the top of the cliff. A glaucous gull is looking down on all the other birds; it might be looking for a chick or egg to eat, or maybe it is just guarding its own nest.
13	Common murres and black-legged kittiwakes in colony (Gull Island, near Homer in Kachemak Bay)	Common murres and black-legged kittiwakes are nesting together in one colony. The murres have their nests on the bare rock; they are sitting on eggs. The kittiwakes have built nests of grass and mud; many nests have kittiwake chicks in them.
14	Tufted puffin colony (Middleton Island, Gulf of Alaska)	These tufted puffins are standing near the burrows they have dug in the soil in their colony. You can also see a common murre on the far left.
15	Least auklet colony (Could be anywhere from lower Alaska Peninsula islands to Aleutians, Bering Sea, or Diomed Islands)	These least auklets are standing on the rocks in their colony. The auklets make their nests in crevices under the boulders. They like to stand on the rocks above their nests and call to each other. One crested auklet is on the upper rock.
16	Red fox (Cape Peirce, northern Bristol Bay)	Red foxes live all over mainland Alaska, and on some islands such as Kodiak and the eastern Aleutians. In these places the foxes eat only a few seabirds. But fur trappers used to put foxes on many islands where they did not live naturally. These foxes killed many seabirds because the birds there were not used to predators.
17	Arctic fox (St. Matthew Island, Bering Sea)	Arctic foxes live in northern and western Alaska, and on some islands such as St. Lawrence Island and the Pribilof Islands. In their natural homes the foxes eat only a few seabirds. But as with red foxes, arctic foxes have killed many seabirds on islands where they have been introduced by trappers.

	<u>Title on Slide</u>	<u>Long Description</u>
18	Raven (Could be anywhere in Alaska)	Ravens live almost everywhere in Alaska. They sometimes eat seabird eggs and chicks.
19	Rat (Could be almost any city outside of Alaska, or several islands in the Aleutians)	Rats are foreign to Alaska. They get here by escaping from ships. They like to live in towns, villages, and seabird colonies if they can. Rats eat seabirds, their eggs, and their chicks. They are very dangerous to seabirds.
20	Black-legged kittiwakes feeding on fish (Cape Thompson, south of Point Hope, Chukchi Sea)	These black-legged kittiwakes have found a school of small fish very close to the surface of the sea. The birds are grabbing the fish while they fly close to the water or sit on it. One kittiwake is carrying a fish. Some murrelets in the background are also waiting to catch fish. When seabirds find many fish together near the surface, the birds can catch fish easily and their chicks do not go hungry.
21	Subsistence hunting for auklets (Little Diomed Island)	These Inupiat boys are hunting for auklets in the traditional subsistence way, using long-handled nets. Alaska Natives are permitted by law to hunt auklets for subsistence.
22	Subsistence collecting murre eggs (St. Paul Island, Pribilofs, Bering Sea)	This Aleut man is collecting murre eggs for subsistence food. He is hanging from a rope that his partners at the top of the cliff are holding. Some murrelets are standing to the man's left; three eggs are on the ledge below him. Alaska Natives are permitted by law to hunt murrelets or collect their eggs for subsistence.
23	Shipwreck (danger of oil spill or rats escaping) (St. Matthew Island, Bering Sea)	This ship (a large freighter) is wrecked on St. Matthew Island. Oil may leak from the ship and kill seabirds. Or rats could swim from the ship to the colony and eat the eggs and chicks of seabirds. You can see a seabird colony to the left of the ship.
24	Oil spill on beach (Prince William Sound, Exxon Valdez oil spill)	An oil spill has coated almost all the stones on this beach with a thick layer of oil. The oil is also on the water and has made a brown stain on the boat. The oil would kill any bird that tried to swim in the water or walk on the beach.

	<u>Title on Slide</u>	<u>Long Description</u>
25	Murre with oil on breast (Chugach Island, Gulf of Alaska)	This murre has oil on its breast (the brown stain). Oil on a bird can also be thick and black. The oil has damaged the bird's feathers, and it is already sick. The bird will die of the cold, or it will be poisoned when it tries to clean its feathers.
26	Fishing nets on beach (Middleton Island, Gulf of Alaska)	These fishing nets were left at sea by their owners. They floated for a long time and finally landed on the beach. This pile of nets contains both trawl nets and drift nets. Fishing nets can catch and kill seabirds.
27	Fishing net with dead birds (On deck of processor vessel, North Pacific Ocean south of Aleutian Islands)	This drift net has caught many seabirds. (They are shearwaters). The birds were caught while they were chasing their own food near the nets. The birds could not get to the surface to breathe, so they drowned.
28	Bird that died from 6-pack loops (Could be anywhere in Alaska or elsewhere)	This seabird (a gull) died because its head got stuck in a plastic 6-pack loop that someone left on the beach. The bird may have died because it could not breathe, or the plastic may have kept it from catching its food.
29	Biologist counting seabirds (Okhotsk Sea, east of Kamchatka Peninsula, Russia)	The biologist is sitting in a boat and counting seabirds through binoculars. Counting birds tells us how important each colony is in that area. The orange suit the biologist is wearing is a life preserver (PFD).
30	Tourists watching seabirds (St. Paul Island, Pribilofs, Bering Sea)	Many people enjoy watching and photographing seabirds. This colony includes least auklets, tufted puffins, and murre. Some communities have special programs to show the local seabirds to tourists. It is important for everyone who watches seabirds not to disturb the birds and to ask permission from people who own the land.

Marbled murrelet doesn't range far, scientists report

By JOHN D. COX
McClatchy News Service

SACRAMENTO, Calif. — The range of the marbled murrelet, the little seabird at the center of the Pacific Northwest's old-growth timber debate, is far less extensive than previously thought, scientists report.

Biologists gathered for the annual meeting of the Pacific Seabird Group heard the results of genetic studies that confirm the murrelet inhabiting the eastern waters off Russia, Asia and Japan is a distinct species from the endangered bird that ranges from the Aleutian Islands to Monterey Bay in California.

Just how this finding translates into numbers of birds is not yet clear, scientists said, but biologist Harry Carter of the National Biological Survey said its meaning is obvious:

"There are less marbled murrelets in the world than people thought."

Comparisons of the DNA of marbled murrelets of the western Pacific with birds of the eastern Pacific revealed sharp genetic distinctions, biologist Vicki Friesen of the Royal Ontario Museum in Toronto reported, and the long-billed murrelet of the

east "clearly merits full specific status."

Because the marbled murrelet nests in the rotting decay of old-growth forest — apparently exclusively — the bird is especially sensitive to coastal logging activities. It is the only seabird that nests in the forest.

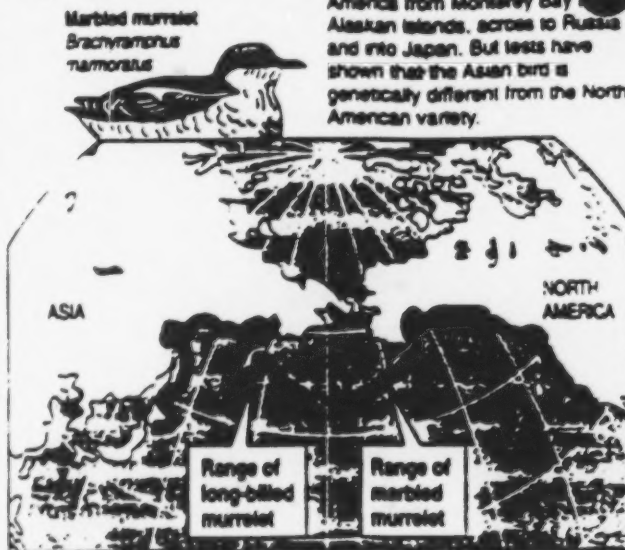
The bird's protected status as "threatened" under Canadian and U.S. federal wildlife laws and as "endangered" under California state law has been the focus of on-going debate in the Pacific Northwest, where timber harvesting has been sharply curtailed, especially in stands of old-growth trees.

Scientists used to think of the newly designated long-billed murrelet as an Asiatic subspecies of the marbled murrelet, and took some comfort in the idea that the range of the bird extended all across the coastal arc of the northern Pacific from Monterey to Alaska to northern Japan.

The new finding eliminates an estimated 30 percent to 40 percent of this range, suggesting not only that the marbled murrelet has less critical nesting range to inhabit, but that the new long-billed murrelet

Shrinking habitat

Biologists have cut the range of the marbled murrelet in half. The range was once believed to extend up the Pacific coast of North America from Monterey Bay, Alaskan islands, across to Russia and into Japan. But tests have shown that the Asian bird is genetically different from the North American variety.



Source: Royal Ontario Museum

McClatchy News Serv

almost certainly is more endangered.

Carter, a murrelet expert and a member of the U.S. Fish and Wildlife Service's murrelet recovery team, said the news at the four-day meeting, which ends today, adds to growing evidence that the murrelet is more endangered than previous thought.

In addition to coastal old-growth logging, the murrelet, like other diving seabirds, is subject to threats from oil spills and gill-net fishing.

In Alaska, where scientists once estimated marbled

murrelets numbered about million, the latest estimate is that 160,000 inhabit the Alaskan coast. World estimates now number between 250,000 to 300,000, Carter said.

Anchorage-based John Platt, a National Biological Survey biologist and incoming president of the Pacific Seabird Group, observed that the long-billed murrelet, however rare, is likely to face more threats from increased logging and oil exploration activities contemplated by western corporations off the Russian coast and in the Sea of Japan.

Rats could outdo spill's damage to island life, biologists say

by CHRIS GRYGIEL
The Associated Press

2-14-94

The oil that spilled from the Exxon Valdez killed hundreds of thousands of marine animals, but biologists in Alaska say the ships that ply state waters often arrive at ports that could prove even more devastating to rats.

"If a ship goes aground on a major seabird colony, the resulting damage (from rats) could be far worse to marine life than the Exxon oil spill," said Art Sowls, a biologist with the U.S. Fish

and Wildlife Service's refuge headquarters in Homer.

A small group of wildlife service biologists in Alaska, who have dubbed themselves the "rat pack," are developing comprehensive plans to protect the state's fragile island ecosystems from the rodents, which are inadvertently introduced into the environment when sea vessels dock or run aground.

Tony DeGange, another fish and wildlife service biologist involved in the project, said the group is just beginning to write proposals

and try to secure money for their plans.

Most island wildlife evolves without predators and is therefore very susceptible when rats enter the ecosystem, DeGange said.

The rodents feed on the eggs and chicks of birds, and DeGange said they are capable of wiping out an entire seabird species on an island. Rats also prey on fauna, and unlike the 1989 Exxon oil spill, biologists say the rodents are a problem that for all practical purposes can't be cleaned up.

The small creatures reproduce rapidly, DeGange said, and are tenacious and reclusive.

"The effects of oil spills are relatively short term compared with what can happen with rats on an island," he said. "You may never get 'em off."

For that reason, biologists are concentrating their preventive efforts on areas they believe are mostly free of rats — including the Pribilof Islands and the hundreds of uninhabited keys in the Aleutian Chain.

However DeGange said the methods biologists will employ will vary, depending on whether an island or group of islands is inhabited.

The inhabited Pribilofs — St. George and St. Paul — are home to about 2.5 million nesting birds and a million fur seals, Sowls said.

The tiny Bering Sea islands, which lie about 300 miles off the west coast of Alaska, are experiencing a boom in the fishing industry.

"The development is so

quick it's almost like a military invasion," Sowls said. "It's great for the economy, but a real challenge to the environment."

Biologists aren't sure rats could thrive in Pribilofs' harsh Bering Sea conditions, but DeGange said with the increased development they don't want to take any chances.

They plan to teach people how to use rat poisons and have them set bait and trap stations in the harbors of St.

Please see Page C-2, RATS

RATS: Biologists looking for funding to protect state islands

Continued from Page C-1

George and St. Paul.

DeGange said scientists hope that with enough training, people in the communities could take over monitoring the traps to minimize the chances of rats gaining footholds in the Pribilofs.

Keeping rodents off the uninhabited islands in the Aleutians and other areas of the state poses a different, and potentially trickier, problem for biologists.

There are millions of seabird colonies in the Aleutian chain, DeGange said, and though many of the islands are remote, uninhabited and undeveloped, major shipping lanes pass within a few miles of them.

If a ship wrecked, he said biologists would have to act quickly to determine if the vessel was likely to contain rats, and if it did, how to respond.

Smaller ships like crabbers probably don't pose much of a problem, but DeGange said bigger vessels that travel long distances like grain ships are likely to have rats.

If a grain ship went aground, my guess is we'd cut out there as fast as we can," DeGange said.

With more funding and research, biologists hope to soon be able to use more complex eradication methods like anticoagulants to get rid of rats if a ship runs aground.

The advantage of advanced techniques like anticoagulants, which cause internal hemorrhaging, is that rats don't seem to build up an immunity to them like they do with other poisons, DeGange said.

Rats can also learn to avoid standard traps, he said.

But if a ship went aground on a seabird colony in the near future, Sowls

said he and members of the "rat pack" would have to stick to basics.

"If a ship went aground today, we'd be out there with snap traps," he said.

BEST COPY AVAILABLE

THE

RAT

ZONE

BROWN rats swarmed over the shipwreck. They scabbled down the hatches and ravaged the holds, consuming edible material throughout the abandoned fish processor. The air filled with the scratchy patter of their tiny feet, the hellish chorus of their frantic squeaks. The fetid stench generated by the defecation of thousands of one-pound rodents was overpowering.

"The rats were everywhere," says Craig Magone, foreman of a salvage crew. "They were crawling up and down on everything, and they weren't afraid of us at all."

The Korean ship Chil Bo San No. 6 went aground in a winter storm six years ago on a remote shore of Unalaska Island, some 800 miles southwest of Anchorage in the Aleutian Chain. By the time a crew came aboard to remove the last of the fuel and toxic waste that summer, generations of Norway rats had reproduced and taken over.

"You'd open up a cabinet or something like that, and they'd jump out on your shoulder," says Magone. "You'd go to reach for something, and your hand would brush one of them, or they'd bite you."

The crew from Dutch Harbor based Magone, owned by Craig's brother Dan, would not sleep aboard the vessel for all the rats, choosing to camp on the beach instead. At one point, they brought a case of common rat poison along and deployed a packet. But the rats soon tore into the unopened case. The next day it was all gone--everything--both the poison and the package it came in.

Though some animals died, the overall population was hardly affected. The rats thrived.

When the ship--wrecked on the edge of the stormy North Pacific--later broke up, Magone says, many rats no doubt made it ashore. "I saw one jump off the stern and swim to the beach," he says. "I know they didn't all drown."

The incident fell short of an environmental catastrophe only because Unalaska Island already had rats, brought there in the early 1800's by Russian traders. Shipwrecks and moored vessels have introduced rats to 20 other Aleutian islands, as well as Kosik and a few islands in southeast Alaska.



Ancient murriet killed by a rat on Langara Island, British Columbia.

Still, the wreck of the Korean fish processor was a jarring reminder of a daily threat of Alaska's 3,000 wilderness islands, home to some of the richest bird nesting habitats on earth.

"The number one thing that Fish and Wildlife Service worries about is the introduction of rats," says Art Sowls, the general biologist who studies Bering Sea and Aleutian birds for the Alaska Maritime National Wildlife Refuge. "If rats were to get on an island, they would severely reduce the population of sea birds--and they would essentially be there forever."

Rats have already infested 82 percent of the world's islands, almost always because of ship traffic. Once established on an island without natural predators, rats destroy millions of birds and other animals, often driving scores of species to local extinction. They permanently alter the habitat.

"Predators have caused 70 percent of all bird extinctions on islands, and rats were responsible for most of these extinctions," according to a report written by Sowls and other biologists in Homer about the danger posed by rats to Alaska's islands.

But Alaska contains some of the world's last untouched nesting paradises. Sowls' worst nightmare goes like this: A ship in the Aleutians breaks open and disgorges breeding rats on Buldir Island, summer home for some 3 million to 4 million birds, one of the largest nesting populations in the Northern hemisphere.

What happens next could lead directly to the world's environmental disaster in Alaska history.

"If rats got on Buldir Island, they would probably wipe out those birds forever," Sowls says. "From a marine sea bird standpoint, that would be far worse than the Exxon Valdez."

No less alarming is the prospect of rats reaching the Pribilof Islands, where the construction of new harbors and a rapidly expanding commercial fishing industry has brought increasing numbers of processors, old freighters and boats close to land. In the summer, most of the world's northern fur seals and at least 2.5 million sea birds come to the islands to breed.

"The introduction of rats to the Pribilofs would be a wildlife nightmare," Sowls says. "They would destroy much of the bird life and

may introduce disease to the seals. Once on the island, rats would be there forever."

In response, Sowls and other federal biologists have organized an emergency rat spill plan--including a squad of volunteer rat commandos that would hit the beachhead of any rat invasion with poisons and traps. On the Pribilofs, Sowls and locals have placed a network of baited traps throughout the harbors. They've even encouraged wild foxes to overrun St. Paul harbor in the hope they'll immediately devour any rat that makes it ashore.

"The foxes are our first line of defense," says St. Paul harbormaster Andrey Mandregan. But will it be enough?

"There is no guarantee it will work," Sowls adds.



WELCOME TO RAT PLANET EARTH

As a species of mammal, Norway rats may be the ultimate survivors. Like other rodents, brown rats are among the most adaptive animals that have ever lived. "With sole exception of humans, the most successful and abundant mammals on earth today are the commensal rats and mice," reads a 1994 report in the U.S. Department of Agriculture.

Rats and mice tend to live commensally, at the expense of humans, and three species--the Norway rat, the black rat and the house mouse--have followed humans all over the world, eating and fouling millions of dollars worth of food, destroying property and spreading disease. Of the three, the Norway rat is the largest and most aggressive. It's the only rat known to survive in Alaska, with populations found in Nome and several other seaside towns--as well as Fairbanks. For reasons no one can explain, Anchorage doesn't appear to have any.

Adults range up to 10 inches long and can weigh more than a pound. They have naked tails slightly shorter than their bodies,

and their fur is usually a course shade of brown. White rats used in laboratories are usually albino Norway rats.

Originally, a burrowing animal from Mongolian steppes, the Norway rat began spreading across Asia thousands of years ago. By the 11th century, the large rodents had reached Europe, bringing numerous diseases, including the bubonic plague. In the 14th century, the Black Death killed an estimated 25 million Europeans, about one-fourth of the population.

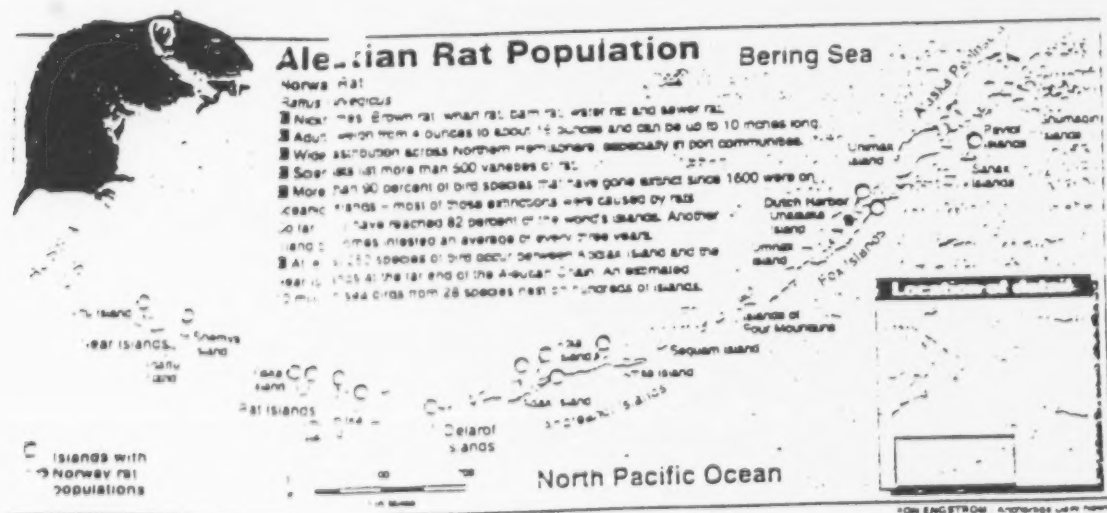
When Europeans began traveling the oceans in search of trade and conquest, the Norway rat accompanied them. They now have nearly world-wide distribution, thriving practically everywhere that humans live. Some scientists estimate there are more Norway rats in the United States than people.

As loathsome as they might appear to people, Norway rats are actually finely tuned predators and scavengers with keen senses, capable of discerning odors and sounds far beyond human capacities. Their extraordinary sense of taste enables them to detect minute differences in their food--a phenomenon that makes killing them difficult because they quickly become "bait shy" of poisoned food that tastes bad or makes them sick. Their eyesight is specialized for nighttime activity. They can see movement and recognize shapes in what would seem total darkness to a human.

Norway rats are strong diggers and good climbers extraordinarily agile and able to jump three feet straight up or across openings of nearly 10 feet. Their bodies are supple, and can squeeze through tiny holes. They can swim well enough to catch tiny fish. They can swim underwater for up to 30 seconds at a time. They can readily swim through the water pipes and sewers into toilets, emerging into houses and buildings by this route, according to a report on rats.

Like most rodents, they love to chew. The hard enamel of their teeth, which never stops growing, allows them to chew through aluminum sheeting, wood, mortar and some concrete. Few human structures are impervious to rats.

They are territorial animals, quick to learn, insatiably curious--yet often strangely fearful of unknown objects like traps. Unless something spooks them, they like to travel down well-used "runs" on their way to forage. Some scientists say they live in hierarchical "societies" with dominant males and local "customs" about what's good to eat and what isn't. Individuals don't live long-- but they make up for their meager life span with a furious reproductive rate. A single female might produce 40 offspring a year in the wild.



Since each generation reaches sexual maturity in three months, given an ideal habitat--with plenty to eat and no predators, like an Aleutian bird colony--a single breeding pair could engender 2 million descendants within three years, according to Sowls. most wild rats survive less than a year--but descendants within three years, according to Sowles

As predators, they are opportunistic, chewing up almost anything, but they prefer to feed on animals or animal remains. They'll attack lambs and piglets. They've been known to bite helpless people or babies. They've even killed elephants in Germany by chewing holes in their feet that never healed. Still, according to Grzimek's Animal Encyclopedia, Norway rats prefer to eat fish, mice, smaller rats, garbage--and birds. Scientists say half of the 54 species of animal that rats prey on are sea birds.



Common murrens on the rocks of St. Paul Island.

When attacking birds, Norway rats will gnaw off legs, break necks, eat eggs and devour chicks. They'll climb on the back of large nesting birds and burrow directly into their bodies while they're still alive. Scientists found 28 dead auklets in a single rat burrow on Kiska Island, suggesting they'll kill far more than they eat.

"They're just the biggest most vicious of the rat species that are commensal with man," says Sowls.

RAT ISLAND BEACHHEAD

FOR thousands of years, most of the western Aleutian Islands were utterly free of terrestrial mammals, with the exception of the first Alaskans. In many instances, that made the archipelago a paradise for nesting sea birds. "Most of Alaska's 38 species of breeding sea birds nest on islands to avoid predatory land mammals," wrote Homer biologist Edgar Bailey in a 1993 report on the introduction of foxes onto Alaska islands.

The situation was the same throughout the world. The very isolation of island habitats made them virtual refuges, allowing sea birds to nest and reproduce on the ground without becoming prey. Then the humans came--to tiny atolls in the South Pacific to the Kerguelen archipelago in the Indian Ocean, to the Aleutians--bringing rats and other small mammals. And the birds died out or were forced to nest only in inaccessible locations and in greatly reduced populations.

"Predation by exotic species on islands world-wide has historically been responsible for the decline or extinction of more sea bird populations than other factors," Baily wrote.

About 1780, a Japanese sailing ship wrecked on what later became known as Rat Island--about 1,300 miles southwest of Anchorage in the Aleutians. Norway rats soon overran that island prompting the Russians to name it only a few years later.

"I'm sure at one time it was a tremendous bird colony," says Sowls, "Now it essentially has nothing except a lot of rats who can survive by eating tidal food. There's no chance of recovery."

What precisely happened on Rat Island will never be completely known--the island is large enough to have supported millions of nesting sea birds. But the fate of British

Columbia's Langara Island--which became infested with Norway Rats in the early 1950's--has been watched closely by Canadian scientists and suggests a chilling scenario.

Located in the Queen Charlotte Islands just across from Alaska in the mouth of the Dixon Entrance, 12.7 square-mile Langara was once considered one of Canada's largest sea bird colonies, summer home to "immense" number of ancient murrelets and five other species of sea bird, according to a recent study. Then a shipwreck in the early 1950's brought rats.

Within four decades, the island was environmentally devastated.

The Norway rats wiped out four bird species--two kinds of auklets and two kinds of petrels. A few tufted puffins managed to survive on an off shore islet. What once might have been "millions" of ancient murrelets--one of Canada's largest concentrations--had dropped to about 24,000 pairs. A species of deer mouse disappeared, too, as well as the smaller black rat, which had reached the island in the 1940's, but hadn't devastated bird populations. In all species that depend on the birds for food have left the island, including eagle and other raptors. Even the island's vegetation had diminished.

The same process occurred earlier in the Aleutians beginning in 1828 in Unalaska where Russian traders had established one of the largest settlements decades earlier. Gradually the rats invaded another 19 Aleutian islands as well as Kodiak with most infestation dating from the early years of World War II. The most recent episode was the most recent arrival of rats on Little Kiska Island, verified in 1990.

Though these rat infestations drastically reduced sea bird populations, they were limited because there were accidental. But the intentional introduction of foxes--first by Russian trappers, later by American fur farmers--ended up wiping out birds on hundreds of islands anyway.

By the 1920's, records show foxes had been introduced to 455 islands stretching from southeast Alaska through the tip of the Aleutians, according to Bailey. Making matters worse for indigenous birds, fur farmers often released arctic ground squirrels, European hares and other rodents to serve as fox food. Throughout the area, bird populations suffered, with certain species of bird disappearing from many islands.

"Few nocturnal nesting sea birds occur on any islands...that are or recently were inhabited by foxes," Bailey wrote. "The greatest species diversity and abundance of nocturnal sea birds in Alaska is on fox-free Buldir Island."

Fortunately for birds, the price of fox pelts crashed in the 1930's, and most fox farms were abandoned. Foxes were trapped or died off on about 390 islands--in many cases because they had destroyed the bird populations and couldn't find enough to eat. Beginning in 1949, federal biologists began killing foxes on Amchitka Island in an effort to save the Aleutian Canada geese--which, by then survived only on Buldir Island, according to Bailey.

Since then, foxes have been eliminated on 21 additional islands and now remain on only 46 islands where they were introduced, according to Bailey. Where foxes were eliminated, sea birds in general and Aleutian Canada geese in particular showed "spectacular" increases in population.

Most islands in the refuge are once again safe for birds. But with the rapid increase in trans-Pacific shipping and Bering Sea fishing, an older and more persistent threat returned. The rats.

What if It Happened Again?

It was the shipwrecks and close calls that got the scientists thinking. Large cargo ships running aground year after year off the Aleutian Pribilof and Shumagin islands. Fishing boats swamping. Processors driven on the rocks. Tramp freighters losing power and drifting helplessly in high seas.

The wrecks included the Chil Bo San No 6--the Korean vessel saturated with rats. But there were other accidents near pristine islands--a grain ship that grounded between two small islands in the Shumagins, a Greek ship that grounded off St. Matthew Island. There seemed little doubt that such ships carried rats. Yet, luckily, none appear to have established themselves ashore.

But that luck could run out.

"It's absolutely for sure that eventually it's going to happen," says Dan Magone, who operates a marine salvage company out of Dutch Harbor and has seen rats on scores of

ships. "Random ships crash out here in random places. It's only a matter of time."

To Art Sowls--the lanky, plain-spoken federal bird biologist from Homer--it's like an equation that leads inevitably to disaster. Add to it the opening of two new harbors in the Pribilofs in 1990, with most boats able to dock at shore for the first time and the threat of rat infestation seems imminent. The horror of it actually keeps him awake at night.

So a few years ago, the Fish and Wildlife Service launched a campaign to raise awareness of the potential problem--issuing warnings and asking for information. They began to collect information about rats from around the world.

What they found out scared them. Rats seem to target certain particularly vulnerable species with small eggs or prolonged nesting periods--common Alaska sea birds like storm petrels, auklets, murrelets and puffins. They found that rats might be especially damaging to the cliff-nesting red-legged kittiwakes of the Pribilofs--home to 90 percent of the world's population.

Worst of all, there seems to be little chance of recovery if that occurs. Though scientists in New Zealand have developed techniques for destroying rats--eradicating them from 45 small islands and islets near their country--they've never been successful on any island larger than a square mile.

"Though the threat of oil spills captures everyone's attention, the ecological repercussions from rats becoming established on certain islands are far worse," the U.S. scientists wrote. "Once rats disperse on any sizable island, eradication is not possible. Therefore, quick action is necessary to exterminate any rats which come ashore before they disperse."

The Fish and Wildlife Service developed two approaches--an aggressive monitoring and total extermination. In the Pribilofs, they developed an extensive rat prevention campaign after meeting with local leaders and fish processors. St. Paul passed a detailed rat prevention law that among other things, prohibits ships with rats from coming within three miles of the harbor. All ships are now required to have rat prevention under way, with traps and good sanitation.

At present, about 100 traps are set in the vicinity of St. Paul harbor and another 100 traps at St. George harbor. Scores of

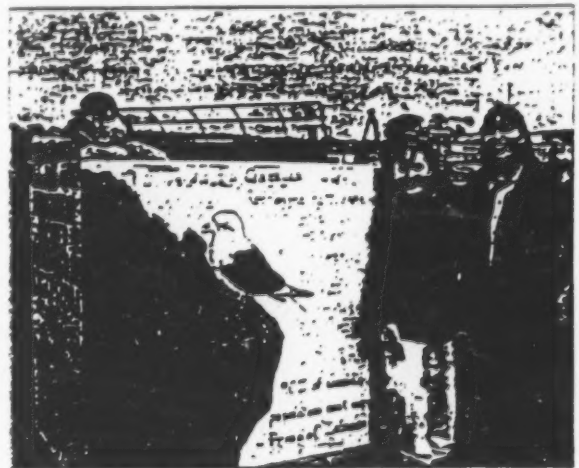
additional traps have been placed inside the harbor-based processing ships and in onshore plants. There have been meetings and training sessions. Paradoxically, wild foxes have been encouraged to infest the harbor in the hope they will quickly devour any rat that scrambles down a line. Scientists believe foxes are indigenous to the Pribilofs and other Bering Sea islands, having reached them over the ice; they coexist with the islands' cliff-dwelling birds.

So far, Sowls says, no live rats have appeared in either village. A dead, mummified rat was found in St. Paul in September 1993, in a case of freight. A single rat was seen trying to crawl down a line from a vessel but harbor personnel responded quickly, chasing it back onto the boat. Then the vessel was ordered out of the harbor, according to harbormaster Andrey Mandregan. Rat droppings have been found in packing crates. There has been some damaged cargo. But, so far, no rats.

"It's all, 'Catch the first one.'" Sowls says. "We need to keep people looking and be aware."

But if the worst happens--the rats get through the protective ring of traps and foxes on the Pribilofs or get ashore on another island through shipwreck--then the rat attack would begin.

"We're forming a team of people who would go if a ship were to go aground on an island," Sowls says. "Basically, what we'd do is clean up the rats like you would an oil spill."



A rat information station at St. Paul was built by local students.

In January, the U.S. Fish and Wildlife Service received an emergency one-year exemption from the federal Environmental Protection Agency to distribute two potent rat poisons on remote islands in the event of a rat spill, and the state pesticide program has certified about 20 people to work with the poisons. The state is also working to obtain permanent authorization to use the poisons on the islands, says Cari Kalf, and environmental specialist with the program.

The substances--Brodifacoum and Bromethalin--would be placed inside tubes that would be spread out in a grid pattern over the beach near the shipwreck. Traps would be employed as follow-up baits replaced as needed, dead rats removed. Scientists would return to make sure the rats were truly gone.

In the environmental assessment of the plan, there was discussion of the possibility that other animals might eat the poisons--which cause internal hemorrhaging or nervous system

"Any losses of eagles would be temporary, whereas rats colonizing all but a tiny island would be permanent."

What If--despite all of the plans and poisons --rats still manage to overrun an island? Is there really no other solution? Next summer, the Canadian Wildlife Service will find out. It has proposed trying to kill off rats on Langara Island and two nearby islets. But it won't be easy.

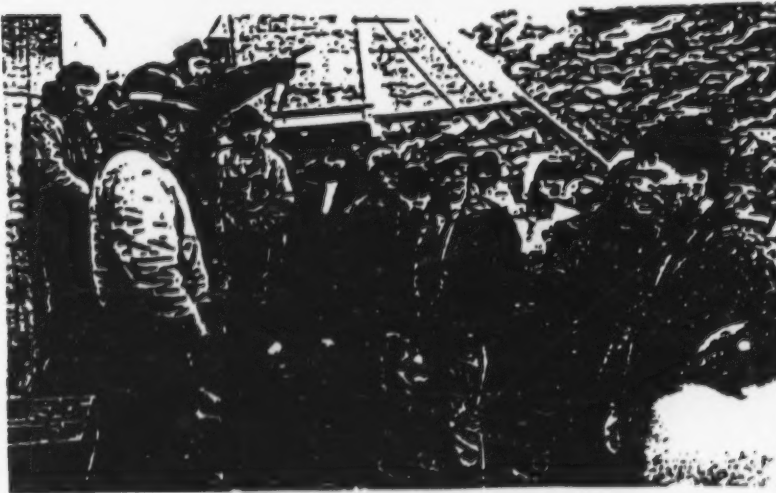
One plan calls for 50 to 60 people to spend two months on the island deploying 3,000 to 4,000 bait stations--at an estimated cost of \$1 million. A variation involves fewer people but would take 10 months. No one knows if either plan will work. Langara is almost 13 times bigger than the largest New Zealand island where similar rat eradication strategies worked.

"If it works, it will be the biggest island in the world where rats have been eliminated," Sowls says.

Depending on what happens, Alaska scientists might try the same approach on four-mile-long Shemya island--the site of U.S. Air Force base in the process of closing. Since World War II, the rugged black-rock island has been infested with rats.

No one knows if these heroic and expensive approaches will work. Protection of Alaska's wilderness islands probably means keeping rats from ever establishing that first beachhead.

"It's scary," says Sowls. "We basically have to prevent them from getting on at all. I'm not confident that we're going to be successful."



St. Paul residents get training for rat-patrol duty.

breakdown. Yet the stakes were so high that the scientists argued it was worth the risk.

"The worst case imaginable, in which a few eagles succumbed after eating poison baits or rats, would be minuscule when considered in terms of rats becoming established on an important sea bird island," the biologists wrote.

This article was in **WE ALASKANS**, a supplement of the Anchorage Daily News. The date it was printed is unknown. Doug O'Hara, a staff writer for this magazine, wrote the article.

HOW LONG CAN ANCHORAGE STAY RAT-FREE?

A few weeks ago, a tiny brown rodent was brought to the Anchorage environmental sanitation office. The chance that it might be a Norway rat alarmed city health officials.

"It was a small rodent, mouse in size, that was basically brown," says Robert Baker, the city's program manager of environmental sanitation. "Was it a house mouse variation or an immature Norway rat? We couldn't answer it."

The rodent was sent to the museum at the University of Alaska, Fairbanks, and experts there quickly informed the city that the specimen was, in fact, a small dead house mouse.

Anchorage was still rat-free and amazingly, appears to be the largest port city in the Northern Hemisphere without a population of rats, according to biologists and health officials.

"I've been in this job for eight years, and we have never yet had a verified report of a wild Norway rat or foot rat in the city in this time," Baker says. "And there have never been any in the recollection of the people I work with."

There have been rumors. A rat supposedly jumped out of a cargo van somewhere in town, but workers quickly killed it. Ken Perry, who operates a statewide pesticide company, says he's talked to people who say they've spied rats over the years, but "they're

very seldom seen." Other reports have turned out to be indigenous muskrats or the European house mouse, according to Baker.

The stakes are high. Like elsewhere in the world, rats could cause millions of dollars in damage at the 1,300 Anchorage establishments that store or sell food. They could spread disease, kill birds and other indigenous wildlife. They could cause fires by chewing through wiring inside walls.

"I take it very seriously" Baker says.

"There is a law in the city that says you cannot own or possess a rat without a special permit." Only the University of Alaska, Anchorage currently has such a permit, he says.

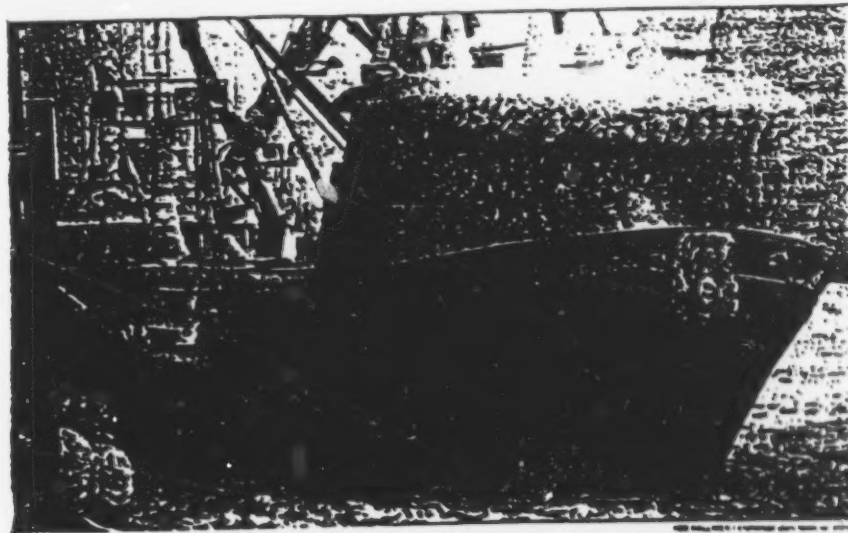
From a rat point of view Anchorage ought to be prime real estate. It's not too cold, there's plenty to eat and there are lots of buildings to hide in. After all, rats live in Fairbanks, hanging out near the Tanana River and the dump, according to Perry. Norway rats also infest ports like Nome, Kodiak, Ketchikan, Juneau and Sitka.

Why not Anchorage?

"In biology, when you have a situation like this, you ask two questions," Baker says. "Is it because the species couldn't get there because of a barrier? Or could the species get there and not survive? I think the answer to the pretty obvious. I think the answer to the first question is pretty obvious. There is no barrier."

So does Anchorage have mysterious environmental virtue that keeps it rat-free?

"That's the question," Baker says. "I don't have an answer for you. No one else has an answer for you, either."



Rats have been encouraged to live and feed around St. Paul harbor in the hope they will rats attempting to leave ships.

BUILD A SEABIRD

OBJECTIVE:

To introduce and explore adaptations that are unique to birds by transforming a volunteer into a bird, and then into a seabird. The importance of seabirds in the "chain of life" is highlighted, and some of the threats to seabird survival are discussed.

BACKGROUND:

Seabirds are unlike any bird you would find on land. Their bills, bodies, and coloration are **adapted** for life in three worlds - water, air, and land. Some of the seabirds fly underwater as well as in the air. That means they must be streamlined in shape yet compact enough to conserve their body temperature in the cold ocean. They must be able to catch slippery food in the water and, in the summer, carry it while flying many miles to their hungry chicks.

In this activity, adaptations common to all birds will first be explored by looking at down feathers, flight feathers, hollow bones and air sacs. Then, special adaptations unique to seabirds will be discussed. These include the oil gland, the salt gland, specially shaped bills, and legs with webbed feet built especially for swimming. Finally, some of the threats seabirds face are introduced including oil spills, trash in the ocean, rats and foxes, and disturbance by people, airplanes and boats.

MATERIALS:

- down jacket or vest
- down feather picture (master provided)
- 2 bird wings (real ones, if available, or make paper ones)
- several drinking straws
- chicken bone
- balloon necklace
- spray bottle
- small bottle of baby oil
- coffee filter hat
- picture of seabird skull (master provided) or actual skull if available
- puffin bills (non breeding and breeding bill, for comparison) if available
- cooked spaghetti
- paper webbed feet
- a handful of styrofoam packing peanuts
- light bulb
- murre egg, if available
- rat and fox puppets
- a piece of fishing net
- a six pack rings
- paper oil splodges
- flash cards (color coded, masters provided)

PROCEDURE:

1. Discuss and define **adaptation** (characteristic or habit that helps a plant or animal survive in its environment). Explain that the aim of the activity is to explore the world of seabirds and examine adaptations by building a seabird. Ask for a volunteer. This person will be turned first into a bird, then into a seabird, and finally into a common murre. He/she will also

be subjected to the various threats a seabird has to endure (the volunteer must have a strong constitution!).

2. Distribute all the flash cards to students to prompt their involvement in the activity.
3. Begin building a bird. See the chart below for adaptations (refer students to yellow flash cards).

GENERAL BIRD ADAPTATIONS (YELLOW CARDS)

ADAPTATION	DESCRIPTION	MATERIAL NEEDED
Feathers Ask the students to imagine they are birds in flight. Ask how it feels to be soaring above the earth. Is it cold? Skin isn't enough to insulate you up there. You have had to adapt to cold conditions. How? With feathers.	Feathers are a unique adaptation found only on birds. Two kinds of feathers are found on all birds: 1) Down feathers - fluffy, under feathers for insulation. These are the bird's underwear. 2) Contour feathers - strong outer feathers for flight. These are the birds clothes.	Dress bird in: - Down jacket - Bird wings
Hollow bones Ask students to think about how much they weigh. Then ask how much they think a bald eagle weighs? It only weighs between 8-14lb and has a 7-8ft wing span.	Hollow bones help a bird keep its weight down! Most of the bird's weight is in the breast and wings (where the flight muscles are). Our bones are filled with marrow for red blood cell production. Birds have marrow only in their breast bone or sternum.	Drinking straw - attach to down jacket Chicken bone - pass around for the students to examine its weight and structure.
Air sacs Ask a volunteer to stand up and become a crow by flapping their wings 20 times in 10 seconds. Ask how much effort that was on their breathing. Harder than walking? Yes!	Air sacs enable a bird to take in enough energy to fly. Birds have lungs like humans, but they require more oxygen intake. Air sacs, rather like balloons, extend from the lungs and between, and into, the hollow bones. During inhalation and exhalation air flows through the lungs and the air sacs to maximize the absorption of oxygen.	Balloon necklace - place around the neck! Also ask a few students to blow air into some balloons and let them go. This demonstrates what would happen if air sacs were removed from a bird. They would sink like a "lead balloon"!!

4. Our volunteer has been turned into a bird, and now this bird will become a seabird. Explain that seabirds live in close association with the ocean. Some seabirds feed at sea but roost on land at night, for example glaucous-winged gulls and cormorants. Others only come to shore for a few months every year to nest. These birds are truly pelagic (ocean-dwelling), and include murre, kittiwakes, and puffins.

5. Spray the volunteer lightly with the water sprayer - our bird is now a water-loving seabird! Discuss the special adaptations of seabirds (refer students to the blue flash cards).

SPECIAL SEABIRD ADAPTATIONS (BLUE FLASH CARDS)

ADAPTATION	DESCRIPTION	MATERIAL NEEDED
Oil gland	The oil gland helps keep a seabird's feathers waterproof. Feathers are kept clean and smooth by constant preening with oil from the oil gland found above the base of the tail. The oil is transferred to the plumage (feathers) with the bill or back of head. There are a few seabirds that do not have an oil gland. Cormorants, for example, are often seen hanging their wings out to dry because they have no oil for waterproofing.	Baby oil bottle - attach to back of down jacket. Ask the bird to try and preen!
Salt gland	To remove excess salt from drinking water and food, seabirds have their own desalinization plant, a salt gland found in shallow depressions in or above the eye socket. The excess salt is extracted from the blood by these glands and eliminated through ducts in the nasal cavity (for most marine birds) or the beak (cormorants, for example, can sometimes be seen shaking their heads vigorously to remove salt from their bills).	Coffee filter hat - place on head of bird. The gland acts like a filter. Puffin skull or picture of seabird skull - show shallow depressions for salt glands.

Bill	Bills are used for preening, picking up food, nest construction, courtship and defense. Compare the bills of seabirds and explain the different feeding niches the birds fit into. For example: - Cormorants have long, hooked bills for gripping slippery fish underwater. - Gulls have stout, strong bills for stabbing and hammering at everything from clams to other seabirds. - Puffins have large deep bills with fleshy tongues and grooved palate to grip slippery fish and zooplankton. These are great examples of adaptations that reduce competition allowing for greater species diversity within the ecosystem.	Seabird bills - compare actual bills if available, or use pictures, such as those in <i>A Guide to Alaska Seabirds</i> (included with the curriculum) or the coloring pages in "Seabird Identification Line Game" on page 17 of the curriculum. Cooked spaghetti - place in mouth of volunteer seabird! This represents sand lance, a favorite fish of many seabirds, including puffins. A puffin can carry at least 20 fish in its bill at one time.
Legs and feet	Legs are set far back on the body to aid swimming. The feet are webbed for swimming and diving.	Paper feet - attach to volunteer.

6. Now discuss the importance of seabird scat (guano). What goes in must come out! Sprinkle polystyrene chips around the volunteer seabird. Thousands of seabirds nesting in a small area eat a lot of food and therefore produce a lot of 'waste' (guano). Why is guano important? It contributes to the chain of life. Guano recycles nutrients in the sea - the nutrients in guano are made available as food for microscopic plankton - plankton is food for fish - fish are food for seabirds and humans. Without seabirds there would be less recycling and fewer available nutrients, and ultimately fewer fish. Seabirds are therefore indirectly important to the fishing industry.

7. Our volunteer seabird will now become a common murre nesting on a cliff. Murres tend to nest in colonies on cliff ledges. They nest together for protection from predators like gulls. Nesting on cliff ledges also reduces competition for space with other seabird species. Murre eggs are light-bulb, or pear shaped, which reduces the chance of it falling off a cliff edge. Murre eggs tend to spin in a circle if knocked or blown by a strong wind; most other bird eggs are oval shaped and would fall readily in windy conditions. Place the light bulb egg between the volunteer murre's feet.

8. Now we will explore why life is not easy for a seabird. In addition to the harsh conditions of living on the ocean, seabirds are also subject to human-caused dangers. Discuss some of the threats listed below (refer students to red flash cards).

THREATS TO SEABIRDS (RED CARDS)

THREAT	DESCRIPTION	MATERIAL NEEDED
Exotic animals	Fox fur was in high demand in the 1920's and over two hundred islands along the Aleutian chain became "fox farms". Seabirds, their chicks and eggs were easily accessible food and many seabird colonies were decimated. The depression killed the fur industry but the foxes, and other predators like rats and ground squirrels, were left on the islands. Refuge staff are working to remove these foxes and restore the seabird colonies. The Aleutian Canada goose, for example, came close to extinction due to fox predation (it breeds along the Aleutian Islands). The goose was placed on the endangered species list in 1967, with fewer than 800 birds left. With the removal of foxes, goose populations are recovering. Up to 15,000 geese are again breeding on the islands and the species status has improved from endangered to threatened.	rat and fox puppet
Trash in the ocean	- Gill net fisheries kill thousands of seabirds every year when birds become entangled in nets and drown. - Plastic debris is mistaken for food by seabirds. The stomachs of some birds have been found full of plastic (plastic has no nutritional value).	net and six-pack ring - place somewhere on volunteer murre
Oil contamination	A single oil spill can kill millions of seabirds, and over time chronic pollution from small spills and leaks poses serious threats. Murre populations nesting on the Barren Islands in the Gulf of Alaska, for example, were particularly badly affected by the 1989 Exxon Valdez oil spill.	pin oil splodge on murre

Disturbance	Boats, planes and people who approach seabird colonies too closely can cause the birds to fly in panic from the nest. This exposes the eggs and chicks to predators, like gulls, and weather. If disturbed too many times nesting colonies could be abandoned.	
--------------------	--	--

9. Summarize the key points of the activity with a "quick recap quiz".

What makes a bird a bird? Describe three unique adaptations of a bird.

- feathers
- hollow bones
- air sacs

Describe three special adaptations of a seabird.

- Oil gland
- Salt gland
- Wings
- Bills
- Legs and feet
- Colonial nesting
- Murre egg.

What shape is a murre's egg and why is its shape significant?

- Light bulb or pear shaped egg.
- Shape reduces chance of falling if knocked or blown by strong wind.

Why are seabirds important?

- Add diversity to ocean life.
- Vital component of food chain (seabirds and eggs are food for ravens, gulls, foxes, humans and other predators, and seabird guano recycles nutrients in the sea and is important food for plankton).

Name three human-related activities that can be harmful to seabirds.

- Trash in the ocean - e.g., gill nets and plastic debris
- Oil spills
- Noise disturbance - Boats, planes and people
- Exotic animal introduction - rats and foxes.

10. A final thought: Next time a seabird flies by, consider the many unique adaptations it possesses and ponder its importance in the "chain of life".

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OPERATED BY THE CENTER FOR MARINE CONSERVATION

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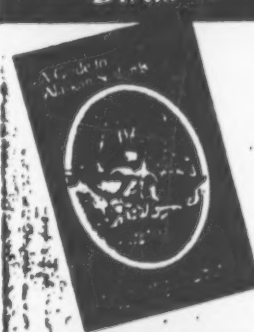
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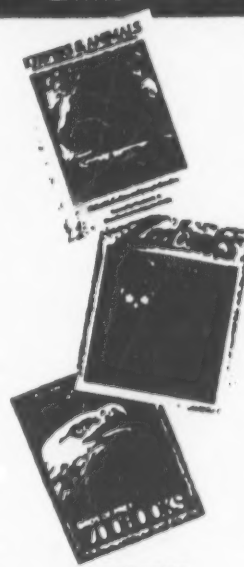
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spills, small spills and
oil leaks are a serious
threat to seabirds.**

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DISTURBANCE

100

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**Disturbance - boats,
planes and people can
cause seabirds to
abandon their nests.**

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**Trash in the Ocean -
seabirds can get
entangled in fishing nets
and drown, or mistake
plastic for food.**

(RED)

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DOWN FEATHERS

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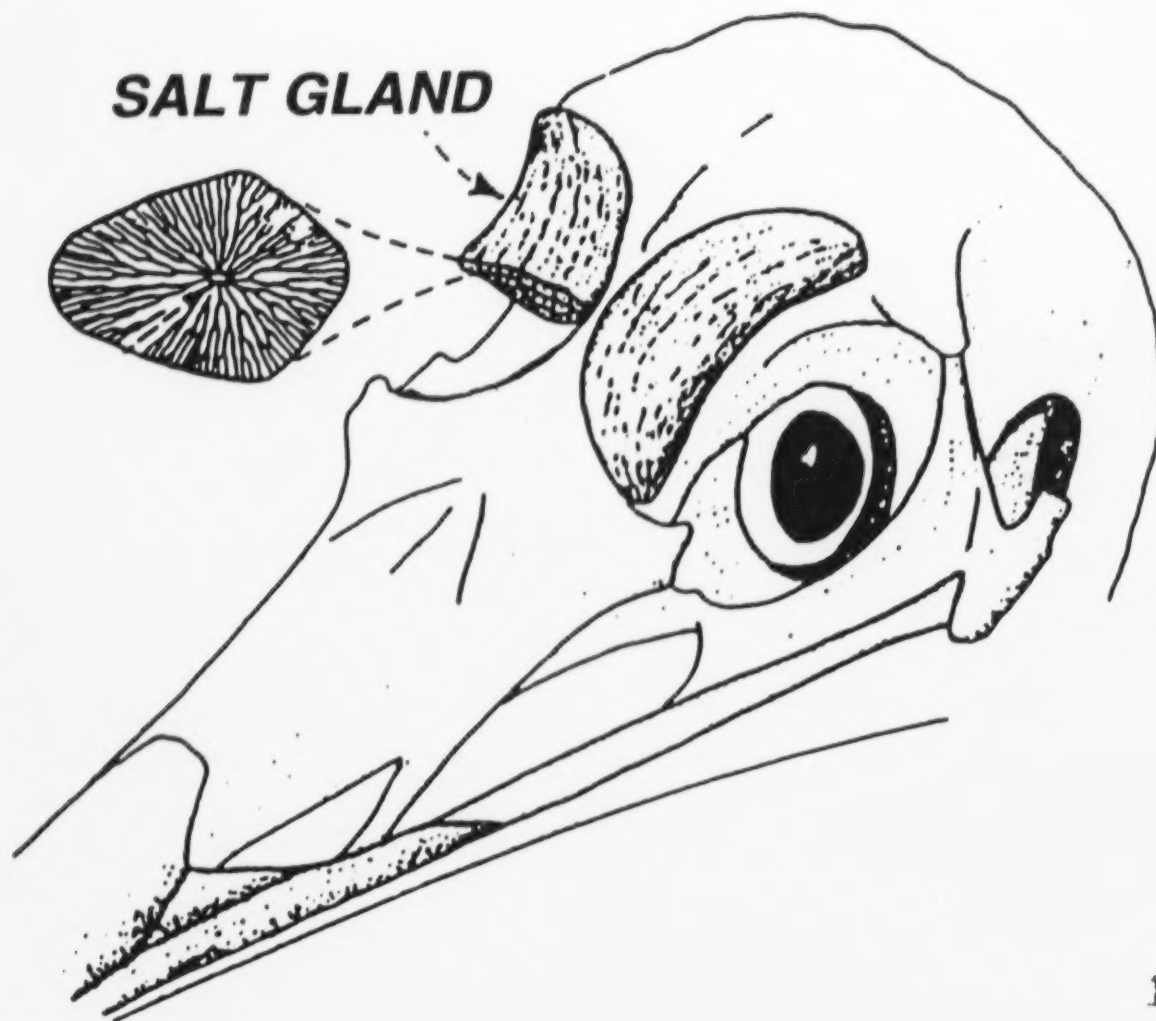
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**Contour feathers -
strong feathers for
flight, warmth and
camouflage.**

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SEABIRD SKULL



A Guide to ALASKA SEABIRDS



Published by the Alaska Natural History Association in
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U.S. Department of the Interior

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A Guide to ALASKA SEABIRDS

Written by Nancy E. Stromsem
Illustrated by Charlotte I. Adamson



Published by the
Alaska Natural History Association
in cooperation with the
Fish and Wildlife Service,
U.S. Department of the Interior.

A Guide to Alaska Seabirds

Written by Nancy E. Stromsem.

Illustrated by Charlotte I. Adamson .

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Map of Alaska



Nesting Sites of Seabirds

Flat Ground

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Glaucous-winged Gull
Arctic Tern
Aleutian Tern

Burrow

Fork-tailed Storm-Petrel
Leach's Storm-Petrel
Ancient Murrelet
Cassin's Auklet
Rhinoceros Auklet
Tufted Puffin

Cliff Ledge

Common Murre
Thick-billed Murre
Northern Fulmar

Cliff

Black-legged Kittiwake
Red-legged Kittiwake
Double-crested Cormorant
Pelagic Cormorant
Red-faced Cormorant

Rock Crevice

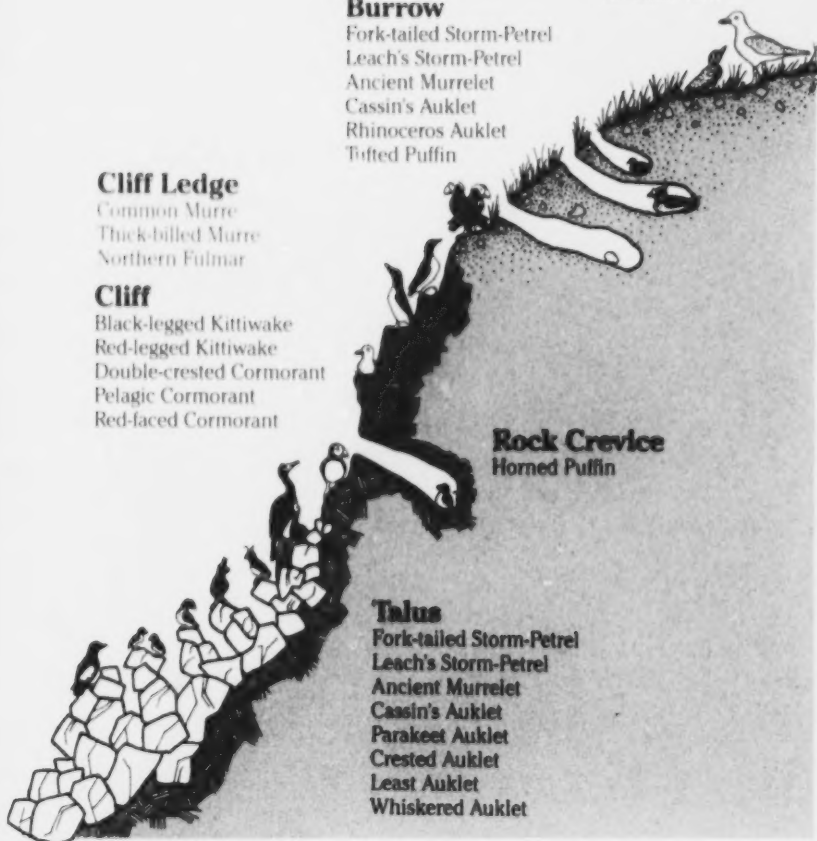
Horned Puffin

Talus

Fork-tailed Storm-Petrel
Leach's Storm-Petrel
Ancient Murrelet
Cassin's Auklet
Parakeet Auklet
Crested Auklet
Least Auklet
Whiskered Auklet

Boulder Rubble

Pigeon Guillemot
Black Guillemot



Introduction

Brightly colored puffins, smoothly soaring albatrosses, raucous colonies of gulls—the coastal and marine resources of Alaska have a wonderful vitality. By the millions, seabirds feed from Alaska's bountiful waters. In summer their numbers may equal or exceed the number of seabirds in the remainder of the northern hemisphere. This book is designed to help Alaskans and visitors to Alaska enjoy one of our most delightful, as well as plentiful, resources.

The book was inspired by a more detailed volume, the *Catalog of Alaskan Seabird Colonies*, published in October 1978 by the U.S. Fish and Wildlife Service. Many of the illustrations, maps and some of the text of this book are taken directly from it; however, this is not just a pared-down version of that book. Tips about identification and details about behavior have been added to assist observers in recognizing the birds.

Readers should realize that not all of Alaska's seabirds are covered here. An extraordinary diversity of marine birds breeds in Alaska, and many others visit from distant seas. Over 73 species have been identified in the Gulf of Alaska alone, and barely half of them are included here. Alaska's common breeding seabirds are described, as well as some of the most common summer visitors.

The species are presented in taxonomic order. This is the scientific classification of plants and animals according to their natural relationships. Identification aids include descriptive text, illustrations and range maps. The birds are pictured and described in their adult, summer (breeding) plumage.

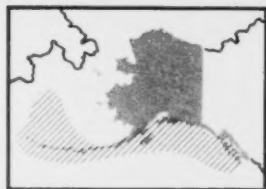
The text begins with suggestions about where to find the species, followed by a section on identification. In cases where the bird may be confused with another species, there is information about how to distinguish one from the other. A third section deals with behavior, specifically, any tendencies to travel in flocks, pairs, or alone, recognizable flight characteristics, and feeding habits. The final paragraph tells about nesting. A few species inspired deviations from that outline!

Range maps illustrate where in Alaska to look for various species. These maps will also generally reflect breeding localities since most species presented here breed in Alaska during the summer.

A more detailed state map locates places mentioned in the text and may help readers not thoroughly familiar with Alaskan geography. For those who wish to record their sightings, the table of contents is designed to double as a check list. One last item to note is the illustration on the opposite page, "Nesting Sites of Seabirds," a guide to the species that nest in various types of coastal habitat.

When identifying a seabird it is important to take note of the clues given in the pictures and text. These clues are general size and shape, color (especially note where dark and light patches are located), special behavior, and habitats. Some birds may appear not to fit any of the pictures; seabirds can vary in color according to age or the season, so look at more individuals if possible. And sometimes birds just don't stay around long enough for you to get a good look—keep watching, and good luck!

Albatross



Albatrosses visit Alaskan waters during the summer. They usually stay far out at sea. If you have the opportunity to take an ocean-going vessel out beyond the continental shelf, you may see one. With luck, it may follow your ship. They are known for wandering great distances, often following ships. Laysan albatrosses are more common than black-footed albatrosses in western Alaskan waters and the southern Bering Sea, whereas black-footed albatrosses are more common than Laysans in eastern Alaskan waters. Short-tailed albatrosses, once the most numerous albatross in the Aleutians, are now on the endangered species list. After heavy exploitation by plumage hunters on their Japanese island breeding grounds, they were thought to be extinct in the 1940s but were later found breeding in small numbers. Their range, as well as their population, is expanding now; but the likelihood of sighting one is nearly nil.

Laysan albatrosses are predominantly white with dark brown or black on the upper wings, back and tail. The underside of the wings is light with dark patterns around the edges. This albatross has flesh-colored legs and a bill that varies from yellow with a grayish tip to mostly gray. If you think you spot one, be sure to notice the back color, since that's the key feature that distinguishes the Laysan albatross from its endangered relative, the short-tailed albatross.

Black-footed albatrosses are dark-bodied birds. Upper parts are dark brown or black and under parts are gray-brown. They have dark bills and, of course, black feet. Some individuals have large areas of white around the bill and rump.

Short-tailed albatrosses look like Laysan albatrosses except the short-tailed albatrosses have a white back.

Long, narrow wings and effortless, gliding flight characterize albatrosses. Their wing spans reach over seven feet, and they have been seen planing close to the water's surface for as long as seven minutes without flapping their wings. They eat fish, squid and offal.

Albatrosses are noted for longevity; life expectancy is about 36 years.



Laysan Albatross

L32"

W82"

Black-Footed Albatross

L32"

W89"

Northern Fulmar

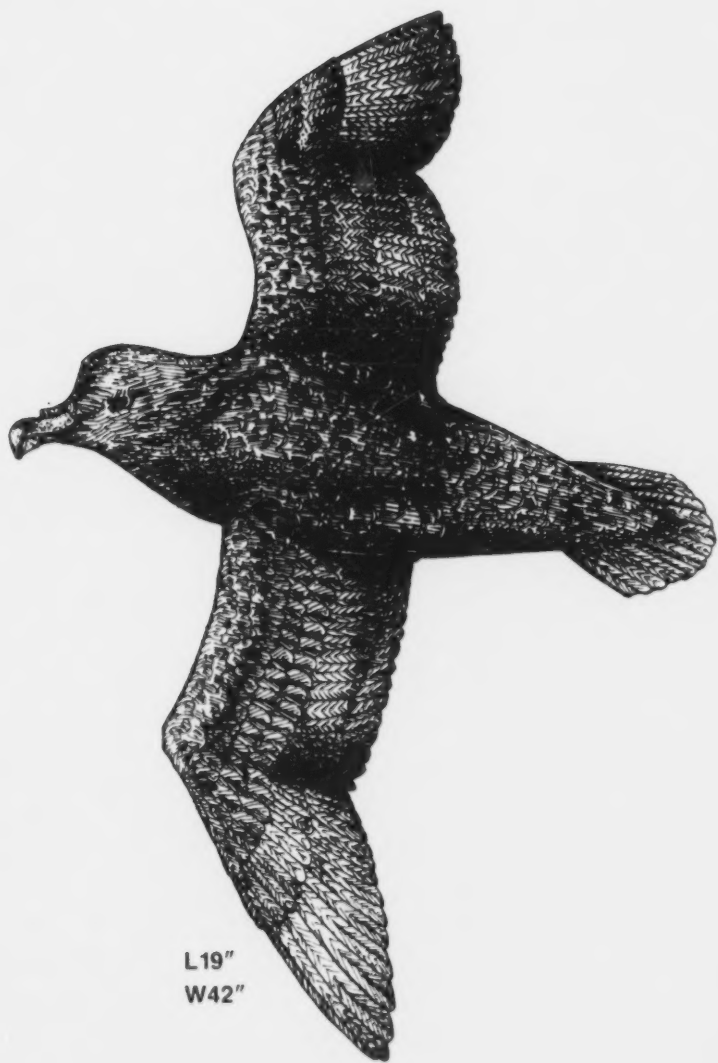


You may spot a northern fulmar anywhere in Alaskan marine waters at any time of the year; however, they are particularly abundant over deep waters beyond the continental shelf. So, the general rule is, the farther out you go, the more likely you are to see one.

The color of northern fulmars ranges from a dark bluish-gray to predominantly white. At colonies in the Bering Sea, light-phase birds predominate. At more southerly colonies, dark-phase birds predominate. One fairly consistent field mark is a lighter patch of feathers, triangular in shape, located beyond the bend in the wing. Look for the short, thick, yellow to yellow-gray bill to avoid confusing fulmars with sooty and short-tailed shearwaters. Also, fulmars are chunkier than shearwaters.

In flight fulmars hold their wings stiffly, alternating fairly rapid wing beats with long glides. They normally disperse widely at sea, but they follow ships, and huge flocks may gather around fish-processing vessels to scavenge on offal. They also flock around reefs or the edges of currents where food—small fish, squid and crustaceans—churn to the surface. They may forage hundreds of miles from their breeding colonies.

Fulmars nest on islands and cliffs, usually in association with other cliff nesters such as murrens and kittiwakes. The fulmars frequently choose the upper, vegetated portions of the cliffs. They have a low reproductive rate, but a long lifespan—sometimes more than 50 years.



L19"
W42"

Shearwaters



If you're riding the ferry in summer, stay alert, and you'll surely see a shearwater or, more likely, a large flock of them. Short-tailed shearwaters are the most abundant birds in Alaska in the summer; sooty shearwaters rank second. Flocks of many thousands of shearwaters are not uncommon, and occasionally assemblages of over a million are sighted in the Bering Sea. Sooty shearwaters are the predominant species in the eastern Gulf of Alaska, whereas short-tailed shearwaters are far more abundant than sooty shearwaters in the western Gulf and the Bering Sea. The Barren Islands are a hot spot for shearwaters. Bird watchers also have great success in Kodiak Harbor, at the mouth of Cook Inlet around Augustine Island, and at the mouth of Kachemak Bay.

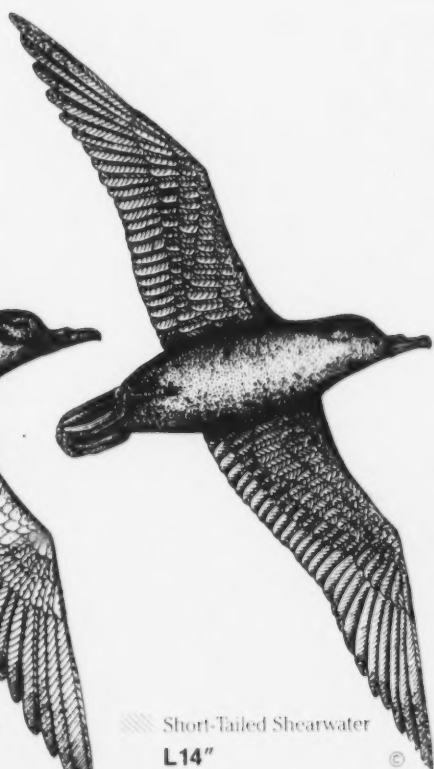
Differentiating sooty from short-tailed shearwaters in the field is difficult. Both have dark brown plumage except on the underside of the wings. They both have slender, black bills. Although coloration under the wing is variable and may be dark to light in either bird, the underwing markings provide the most reliable means of differentiating the two species.

The **sooty shearwater** has a large, irregular white patch that covers most of the underside of the wing. As it flies overhead, its wings appear a mixed pattern of light and dark.

The **short-tailed shearwater** has a silvery sheen on all feathers under the wings. The silver reflects light consistently, making the entire underwing appear bright white in the sun or gray on cloudy days.

If you think you're watching shearwaters, try to get a good look at the slender bill as that's a good key to distinguish sooty and short-tailed shearwaters from more thick-billed fulmars and uncommon pale-footed shearwaters.

Both sooty and short-tailed shearwaters are sometimes referred to as "whale birds" by fishermen, due to their habit of congregating around whales, apparently to feed on krill, fish and squid brought to the surface by the mini-currents created by the whale's swimming.



Fork-Tailed Storm-Petrel

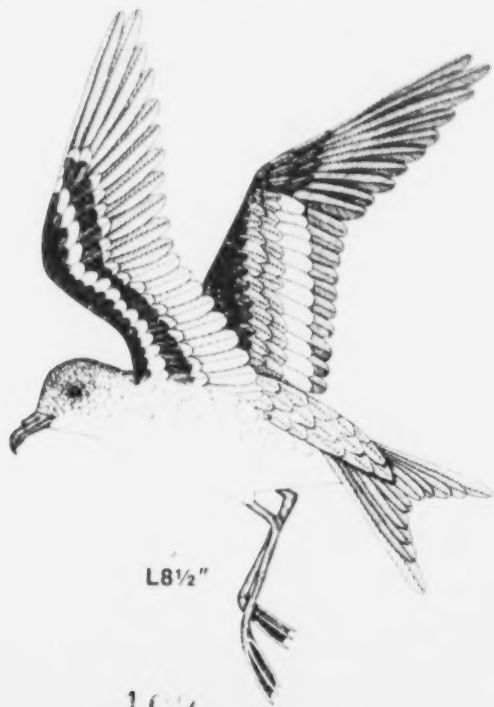


If you're out in a fishing boat with lights, this bird is the one most likely to drop in on you. In summer it's fairly common in marine waters all around the southern half of the state. You're not likely to see one near shore; but, when the weather's exceptionally stormy at sea, they sometimes seek refuge in calm bays. Generally, the farther out you go, the more likely you are to see a fork-tailed storm-petrel.

Among the smallest of Alaskan seabirds, fork-tailed storm-petrels are pearl gray above, blending to whitish below. Light and dark colors contrast on the underside of the wings, as depicted. The bill and legs are black. Of course, the tail is forked.

The flight of storm-petrels is swift, darting and erratic. They normally feed at the surface on small crustaceans and other plankton, and are also attracted to offal spilled from fishing vessels and to drifting carcasses of whales and seals. The Eskimos called these birds "oil eaters" as they appeared to skim the oily surface of water around wounded whales and seals.

Storm-petrels are nocturnal on land, so their colonies are difficult to locate. It appears, though, that they nest wherever a comfortable hole presents itself. They may nest in talus or other natural cavities, dig their own burrows, or nest in unoccupied burrows of other birds.



Leach's Storm-Petrel



To see a Leach's storm-petrel, you'll have to go way out to sea or visit their breeding colonies. You're far less likely to see a Leach's than a fork-tailed storm-petrel.

Leach's storm-petrel is sooty blackish-brown all over except for a white rump patch. It has a black bill and legs. In lighting conditions where it's difficult to recognize color shades, the white rump patch is the easiest way to tell Leach's from the more common fork-tailed storm-petrel.

These birds tend to fly an irregular course, with sudden, swift changes in direction. They forage in areas where waters are 2,000 meters deep, or deeper, on a variety of zooplankton which they obtain at the water's surface. They forage over vast areas, even during the nesting season.

Parents share responsibility for incubating the egg, alternating care in shifts of several days. Since the returning adult comes to the nest late at night, their breeding grounds are hard to locate. Although they seem to prefer to dig their own burrows, these storm-petrels sometimes nest in unoccupied burrows of tufted puffins.



Cormorants



Four species of cormorants occur in Alaska. In order of most to least abundant they are red-faced, pelagic, double-crested, and Brandt's cormorants. Common to all these cormorants are certain characteristics that make them easy to recognize, including bold upright posture, shiny black plumage, feathers that absorb water, consequent posing with wings spread to dry, hooked bills and snake-like necks, which are sometimes the only part above water as they swim.

Brandt's cormorants, at the northernmost extremity of their range, are sometimes sighted in southeast Alaska and as far north as Prince William Sound. They are large cormorants with blue throats.

Double-crested cormorants inhabit both fresh and saltwater areas on the coasts of the Gulf of Alaska and Bristol Bay. They have yellow throats.

Pelagic cormorants may be found anywhere along the Alaskan coast where there are cliffs for nesting and rocks for roosting. They are smaller than other cormorants. They have some deep red color on the face, but it's a smaller area than on the red-faced cormorant and can't be seen from a distance.

Red-faced cormorants have bright red faces. The red extends back beyond the eyes. Listen up bird listers! These cormorants are found only in Alaska and possibly the Commander Islands of the USSR. There's a good chance of seeing them along the ferry routes in the Gulf of Alaska anywhere near shore between Cordova and Kodiak. In the past, red-faced cormorants have been seen nesting on Gull Island, an easy tour from Homer.

Cormorants tend to travel in small flocks, often flying along the shore in lines or "V" formations. Double-crested cormorants fly with their necks crooked and their heads up; Brandt's cormorants fly with their necks slightly crooked or straight out; the others fly with their necks straight out. Cormorants rarely stray more than a few miles from shore. In inshore waters they capture a variety of fish and bottom-dwelling crustaceans by diving and underwater pursuit. Their feathers absorb water, enabling them to lose buoyance and improving their ability to dive and swim underwater.

It's rare for a Brandt's cormorant to occur this far north and, if any breed here, there are probably less than a hundred. The other three species share mixed colonies as their ranges overlap. Cormorants do not necessarily return to nest in the same place year after year. For colony sites they usually choose precipitous cliffs, although the double-crested cormorant may choose more gradual slopes, flat islets, or even trees for nest sites.



Pelagic Cormorant

L26"

W39"

Pomarine Jaeger



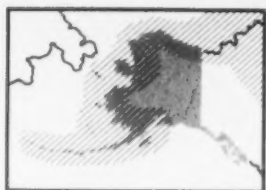
The largest, most rotund jaeger, the Pomarine Jaeger has regular, purposeful wingbeats noticeably slower than those of the Parasitic Jaeger. Its bill is also larger and the adult's tail streamers form flat, twisted knobs at the tip. Its black wing linings are visible at a distance. A white patch near the wing tips is visible at closer range. Most of the adult Pomarines are light beneath with some barring but there are instances of nearly all black coloring. Juveniles are usually strongly barred on back and underneath and tail streamers are nearly invisible. In all ages, the white at the base of the primary feathers is more extensive than in other jaegers.

The Pomarine Jaeger breeds on low, wet tundra interspersed with lakes and ponds. It is known to chase large gulls and will migrate along marine waters inshore and off. It winters at sea.



167

Parasitic Jaeger



Jaegers are predatory seabirds with long, central tail feathers and pointed, angled wings. The adult plumage may take up to four years to develop, and variable plumages during growth phases make identification a challenge.

The Parasitic Jaeger is of medium build, neither bulky nor slight, and has a swift wing stroke. In all phases there is a light touch of white on the upper wings and pointed tail streamers. The light-phase juvenile has muted barring below as compared to the pronounced barring of the dark-phase juvenile. Both juveniles have a distinctive rufous-brown tint and gradually lose their barring with age.

The Parasitic Jaeger breeds on low tundra and in stony areas. It is rarely seen inland, preferring the Alaskan shores and the Aleutian Chain. Of the three types of jaegers (Pomarine, Parasitic and Long-tailed), the Parasitic and Long-tailed can be commonly seen in Alaska, the Parasitic most frequently.



L19"
W42"

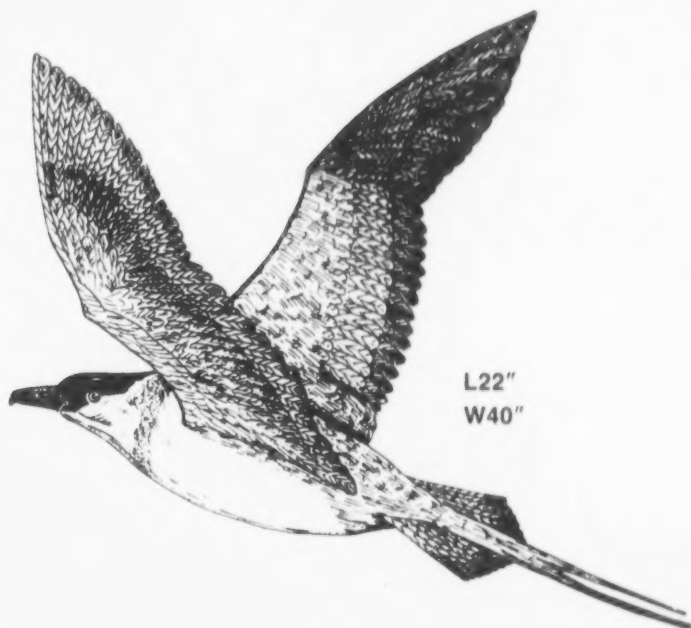
Long-tailed Jaeger



The Long-tailed Jaeger is the most graceful jaeger, due to its ternlike flight and long, pointed tail streamers. Its light build is offset proportionately by these tail streamers in all ages, although the juveniles are more rounded.

In all plumages, there is a noticeable contrast between the gray-beige mantle or back and the darker flight feathers. An adult jaeger lacks the white patch on the underwings and the strong barring evident on the juveniles, as well as the grayish overall tone. Some juveniles also exhibit a very light head and nape.

The Long-tailed Jaeger migrates along marine waters, sometimes far offshore. They nest on the wet coastal tundra and dry up-land tundra of the interior.



Glaucous Gull

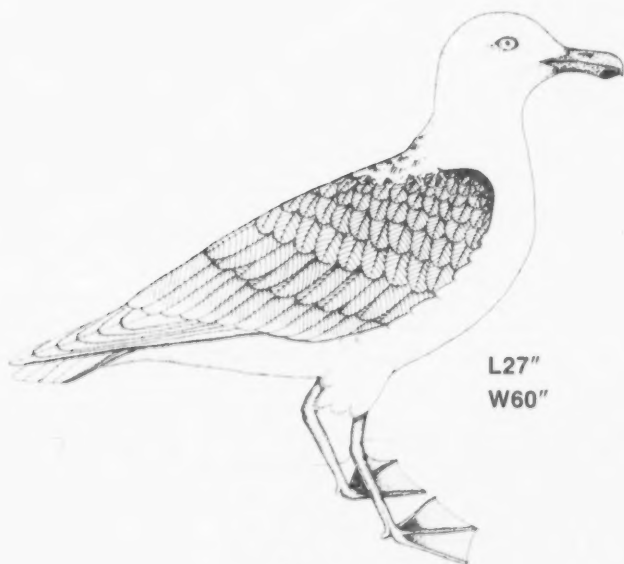


Glaucous gulls frequent coastlines, bays and harbors from Nunivak Island northward along the coasts of the Bering Sea and the Arctic Ocean. On very rare occasion, one strays into the Gulf of Alaska during the summer.

Glaucous gulls are the largest gulls in Alaska. They're mostly white with a pale gray back. Legs are flesh-colored or yellowish. The bill is yellow with a bright red spot on the lower mandible. If you think you've spotted one, check the wing tips. Wing tips should not have any black or gray. If the wing tips are white, it's either a glaucous gull or an uncommon ivory gull. Ivory gulls are smaller than glaucous gulls, and they have black legs. Glaucous gulls also resemble glaucous-winged gulls. Glaucous gulls are the larger, paler, and normally the farther north of those two species.

Glaucous gulls are on the wing a lot. They fly gracefully, with slow, continuous wing beats. Noted as predators, they steal food from birds of other species and, throughout the breeding season, raid nests of other birds for eggs and young.

They nest in scattered pairs or small groups, closely associated with other species. Nests of grass, seaweed, moss and debris are placed on slightly elevated ground or, more often, on cliffs or ledges.



L27"
W60"

Glaucous-Winged Gull



Ubiquitous is the word to describe these gulls. They are abundant, and they inhabit all types of water from fresh to deep offshore. Lured to the artificial food supplies associated with human settlement, they are common in the maritime provinces of Alaska. Groups of 10 to 500 may be seen loafing on rocks or beaches. You may spot them anywhere around the Gulf of Alaska or the southern Bering Sea, but near Kodiak is probably the best place to look.

Glaucous-winged gulls are large, white birds with gray backs. Their wing tips are gray with just a spot of white at the rear edge of the feathers. Their legs are pink. Like herring gulls and glaucous gulls, these have a yellow bill with a red spot on the lower mandible. Many of the gulls you'd see loafing during the breeding season are nonbreeding birds less than four years old. Because they still retain some of their immature color pattern, they look dirty.

Glaucous-winged gulls often travel in groups, which may be quite large as they leave an area en masse after feeding. They are omnivorous and highly opportunistic in their food habits. Far at sea they eat a variety of pelagic fish and crustaceans. In tidal zones they eat crabs, limpets and sea urchins. Garbage and offal draw them to harbors and, in season, they'll go up salmon streams to feast on spent salmon. They also eat insects and small mammals. Around their colonies they prey on eggs, young and adults of their own as well as other species.

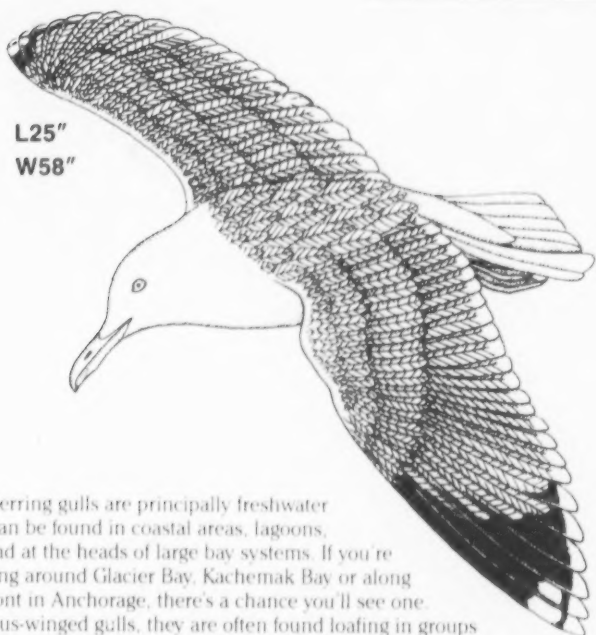
At large, multispecies colonies, it's typical for the glaucous-winged gulls to make up only a few tenths of a percent of the total population. They nest on sandbar islands, the tops of more rugged islands, along beaches and also on cliffs. Nests are usually grass-lined scrapes.



L26"
W58"

171

Herring Gull



L25"
W58"

In Alaska herring gulls are principally freshwater birds, but can be found in coastal areas, lagoons, estuaries and at the heads of large bay systems. If you're bird watching around Glacier Bay, Kachemak Bay or along the waterfront in Anchorage, there's a chance you'll see one. Like glaucous-winged gulls, they are often found loafing in groups along beaches and on rocks. They seldom venture far from land in summer but, beginning in October, some move offshore and they may be found hundreds of miles from shore through early spring.

These are large gulls, predominantly white with pearl gray backs. Their wings have black tips with white spots just along the rear edge. The wing tips are the key to distinguish herring gulls from glaucous-winged gulls. Herring gulls also resemble Alaska's other inland gull, the mew gull, so check the overall size, the bill for shape and color, and the legs for color. Herring gulls are larger than mew gulls, have longer bills, which are yellow with a red spot on the lower mandible, and have pinkish flesh-colored legs.

Their graceful flight, with slow but strong wing beats, resembles that of the glaucous-winged gull; and the two species often travel in mixed flocks. Herring gulls gather in noisy numbers at garbage dumps and canneries to feast on waste; but they also forage for carrion, live fish, and a variety of inter-tidal prey. Inland, their diet may include insects, small mammals and berries as well as fresh-water fishes and invertebrates. Also, other species of seabirds—adults, eggs, and young—fall prey to herring gulls.

Their colonies are located on the margins of inland lakes and streams as well as on sea strands and islands. Generally nests are simple depressions on the ground, sparsely lined with grass, moss, seaweed, or other plant material.

Mew Gull

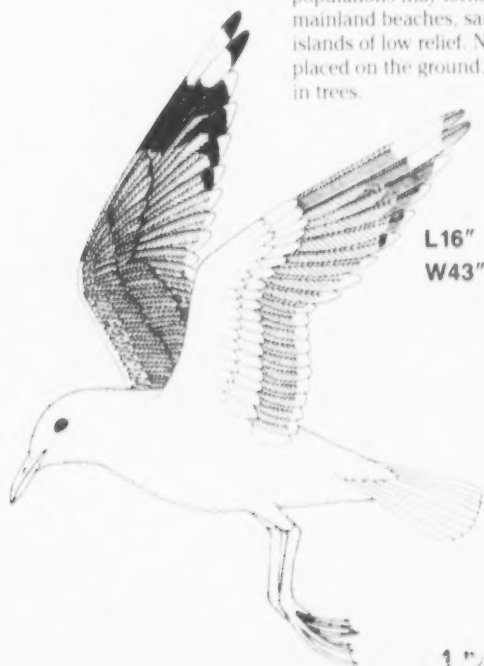


These are the gulls most people see at Denali National Park in the summer or in freshwater or coastal marshes around Anchorage. In winter they are particularly abundant in inside waters of southeast Alaska. Both summer and winter they tend to remain near shore rather than heading out to sea.

These small gulls are predominantly white with pearl gray backs and white-spotted, black wing tips. Their plumage is the same as the herring gulls. Mew gulls differ from them by being smaller, having yellowish legs and very short, unmarked greenish-yellow bills that earned them their other name, short-billed gulls. Mew gulls also resemble black-legged kittiwakes. Their general body and head shapes are alike. To differentiate, notice the white on the wing tips of mew gulls and their yellow, not black, legs.

A large flock of fairly small gulls is likely to be kittiwakes. Mew gulls tend to be more solitary than other gulls and are much less vocal than kittiwakes. Along the coast mew gulls eat small, surface-shoaling fish. They forage on beaches and mud flats for a wide variety of intertidal marine life and are also attracted to garbage dumps, canneries, and salmon spawning streams.

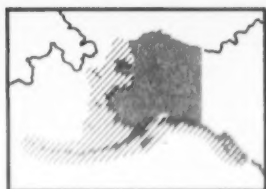
Interior nesting mew gulls scatter along streams, lakes and marshy tundra, rarely forming distinct colonies. Coastal populations may form small colonies on mainland beaches, sandspits, and on islands of low relief. Nests are usually placed on the ground, but occasionally in trees.



L16"
W43"

173

Black-Legged Kittiwake



This is a familiar species almost everywhere on the Alaskan coast. Black-legged kittiwakes are found in just about every type of water from deep offshore to estuaries and lagoons. They often bathe in fresh water as well. Look for them whenever you're at the beach—clamming at Clam Gulch, ambling along the Homer Spit, or fishing in Resurrection Bay. You will also see them from the ferry in Prince William Sound. If all else fails, a tour from Homer to Gull Island will surely produce.

Black-legged kittiwakes are small gulls, predominantly white with gray backs. The wing tips are solid black both top and bottom. They have yellow, spotless bills and, of course, black legs. They are similar in size to mew gulls.

Observers have characterized kittiwake flight as a rowing motion, with shallow wing beats and a lighter, more buoyant flight than most gulls. They are often found in large flocks, especially if they are feeding. Even during the breeding season, they range far from land. Their food, consisting primarily of small fish and crustaceans or other invertebrates, is obtained at or near the water's surface.

Kittiwake colonies are noisy and conspicuous. Sites include offshore islands, rocks, and mainland cliffs. Although most colonies are located next to the open sea, some are found in fjords. Nests of grass, moss, or other plant materials and mud are typically constructed on precipitous cliff faces.



Red-Legged Kittiwake

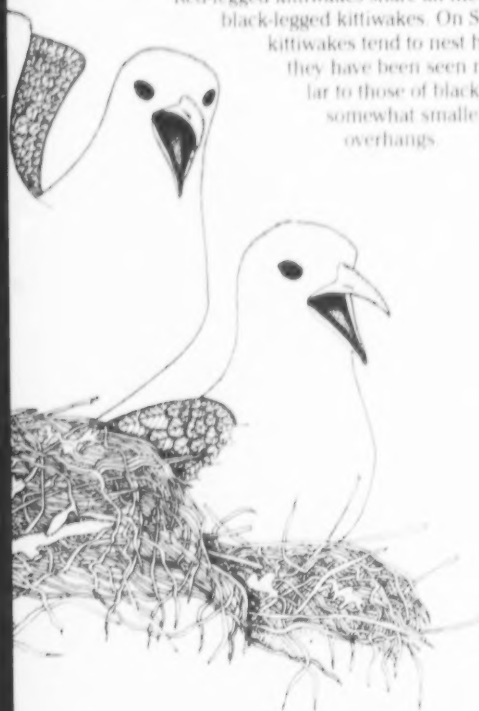


For the birder who has everything, we recommend a trip to the Pribilofs to tick the red-legged kittiwake off a bird list. Ninety-seven percent of the world's red-legged kittiwakes nest there on St. George Island. For the birder who hasn't got a trip to the Pribilofs, there's some consolation. Red-legged kittiwakes are highly pelagic; that is, they range far out at sea. Although records are few, there have been sightings in the Gulf of Alaska.

Except for obvious red legs and a few subtle differences, red-legged kittiwakes look like black-legged kittiwakes. They are predominantly white with gray backs and black-tipped wings—that's both top and bottom. For the experienced birder, the subtle differences are a shorter bill, rounder head, and darker wing linings than their black-legged congeners.

If you're willing to use "rowing" to describe the flight of black-legged kittiwakes, use it for the red-legged as well. Red-legged kittiwakes prefer to forage offshore and regularly go beyond the continental shelf. They feed primarily on small fish by plunging from some height above the surface.

Red-legged kittiwakes share all their known breeding grounds with black-legged kittiwakes. On St. George Island, the red-legged kittiwakes tend to nest higher up on cliffs, but at other sites they have been seen nesting side by side. Nests are similar to those of black-legged kittiwakes, except they're somewhat smaller and built more often under overhangs.



Red-Legged Kittiwake

L15"

W33"

Bonaparte's Gull



Fishing for salmon on the Kenai River will likely produce a Bonaparte's gull for your list. During summer they are found most commonly along streams and rivers throughout inland areas of central and western Alaska. Outside of breeding season they frequent coastal areas and become particularly common near glaciers and along waterways of southeastern Alaska during fall migration.

This small gull has a black head and white wedges on the fore edge of the wings. The bill is black, and the legs are bright red.

Buoyant, graceful flight is evident, especially during feeding. They eat insects while inland. In coastal areas, they also eat small fish and crustaceans. After leaving breeding areas, these gulls often travel and feed in loose flocks.

They build nests of small sticks and twigs lined with moss in conifers of wooded muskeg areas.

Sabine's Gull



Sabine's gulls breed along the Arctic and Bering Sea coasts from Demarcation Point to northern Bristol Bay. You could see them during summer along coastal areas of the Yukon-Kuskokwim Delta, or perhaps along the road from Nome to Teller.

In Alaska, Sabine's is the only gull with a forked tail and one of only two common gulls with a dark head. Distinctive features include a slate gray head, gray back, flashy white triangles on the rear edge of the wings, and black wing tips. The remaining plumage of this small gull is white. Look for black legs and yellow on the tip of the black bill.

Sabine's gulls have light, buoyant flight and usually travel alone. They feed largely on insects caught in the air or picked up from the surface of ponds. They sometimes forage on mud flats and along margins of sloughs. Along the sea coast they may drop lightly to the water, and just as their feet touch, snatch small crustaceans or fish and fly on.

They nest in grass-lined depressions in low, wet tundra, either in small colonies or as scattered pairs.

Bonaparte's Gull

L13½"

W33"



Sabine's Gull

L13½"

W33"

Arctic Tern



Arctic terns are common in coastal areas of the Gulf of Alaska and the eastern Bering Sea. They frequent coastal lagoons. An easy place to see them is on the road just south of Anchorage. They breed at Potter's Marsh.

Arctic terns are small, graceful birds. They are predominantly white with black on the top of the head and back of the neck, gray on the back, and silver-gray at the tips of their long, pointed wings. They have forked tails. Beaks, legs and feet are deep red.

They are gregarious, noisy and protective. That is, they attack people who approach too close to their nests. Their graceful flight is like a barn swallow's with rapid wing beats and frequent hovering and darting. While looking for fish they patrol the water with their beaks pointed down, and that is one way to distinguish them from small gulls, which fly with their beaks held horizontally. They prefer a diet of small, smelt-like fish.

Arctic terns breed throughout the interior region as well as along the coast. They nest near fresh or salt water on sandspits, beaches, rocky shores and islands, or on wet tundra. The nest is a small depression on the ground, lined sparsely with grass, or not at all. They nest in small- to medium-sized colonies or as scattered, isolated pairs. Nest sites are frequently moved from year to year in response to predators and other factors; only the largest colonies tend to persist at the same locations.

The Arctic tern has the longest migration known. It is the only seabird breeding in Alaska that travels as far as the Antarctic to winter. Travelling 11,000 miles each way, twice a year, it stays in daylight at polar regions more than any other species.



L 15½"
W 31"

Aleutian Tern

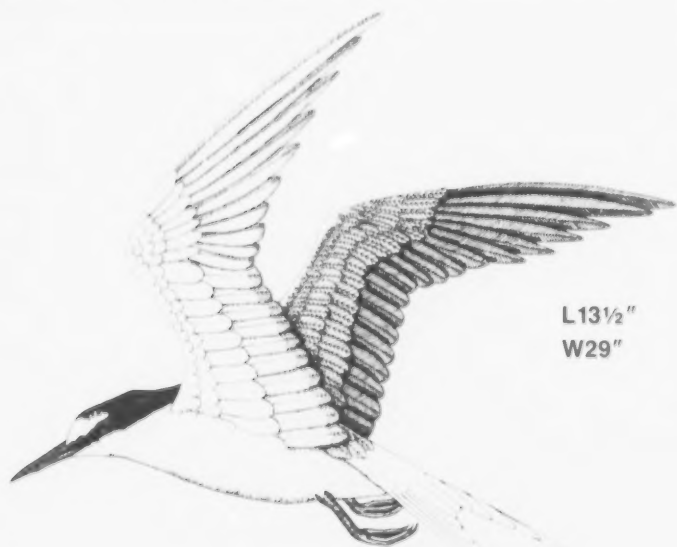


In some of the same coastal areas frequented by Arctic terns, you may spy a second, less common species, the Aleutian tern. Homer is one of the more convenient places to see them.

Resembling the Arctic tern, the Aleutian tern is slightly smaller, somewhat darker and has black bill and legs. Another distinctive feature is the white forehead, as pictured. Observers should be aware, though, that Arctic terns in winter plumage—as late as May and as early as August—also have white on the forehead, but there's a definite difference. The Aleutian tern has a sharply outlined white streak, more like a racing stripe, whereas the Arctic tern's white patch is larger and less well defined, more like a balding head. Their very different calls are also a good key to differentiation. The Aleutian tern uses a three note whistle, whereas the Arctic tern has a harsh cry.

Like Arctic terns, Aleutians have a very graceful flight, but their wing beats are slightly slower than the Arctic tern's. They forage a little farther offshore than Arctic terns. For their own dining pleasure, they choose krill; but they feed small fish to their young, perhaps to minimize the number of trips necessary between foraging areas and the nest.

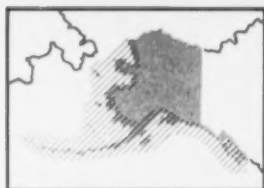
All known colonies of Aleutian terns are located on or very near the coast. They frequently occur with Arctic terns in mixed colonies. Their nesting habitat includes sandspits, sandbar islands, or the flat, vegetated tops of rugged islands. The colonies may shift location from year to year.



L 13½"
W 29"

173

Murres



Common and thick-billed murres are found throughout Alaskan marine waters. Common murres make up a higher proportion of populations in the Gulf of Alaska, whereas thick-billed murres tend to outnumber common murres in the Bering Sea. Collectively, murres are probably the most numerous of all pelagic birds breeding in Alaska, and you're almost sure to see one if you're in a boat in the western Gulf of Alaska.

Murres are sufficiently different from other seabirds as to make them readily recognizable; however, it takes a discriminating bird watcher (and a bird watcher lucky enough to get close) to tell the difference between a common and a thick-billed murre.

Common murres have a more brownish head and back, a thinner bill, and less of a point where the bird's white breast joins the black neck.

Thick-billed murres have a blacker head and back, a thicker bill, which sometimes, but not always, has a white stripe at the edge, and a sharp point near the throat where the white breast meets the black neck.

Murres are highly gregarious. They fly and rest on the water in large flocks, particularly large in winter. They dive for food, and Alaskan fishermen have reported catching murres in crab pots set as deep as 65 fathoms, or 390 feet! Murres prey on small, herring-sized fish and larger marine crustaceans; the particular species in the diet vary both seasonally and locally.

During breeding season murres congregate on cliffs and ledges. Colonial nesting is highly developed, and a shoulder-to-shoulder arrangement on the nesting ledges is the rule. Murres are notable for the complete absence of any nest-building behavior. They lay their single egg on bare ground or rock ledges.



Thick-Billed Murre
L18"

Black Guillemot



This bird is very similar to the pigeon guillemot, but it only nests in the far north. However, if you happen to be collecting driftwood along the barrier islands of the Beaufort Sea or on the Chukchi Sea coast, you'll have a good chance of running across one of Alaska's more uncommon marine bird residents. Black guillemots stay in inshore waters or leads in the ice along the northern coast.

Their plumage is all black except for some white on and under the wings. Large, all-white wing patches distinguish them from the very similar and more common pigeon guillemot, which has black wedges intruding into the white of its wing patches. Black guillemots also have striking red coloring on the legs and inside the mouth.

They are usually seen in low numbers, and their flight is characteristically rapid and close to the water. They are good swimmers; they dive to forage on or near the bottom for small fish, crustaceans and marine worms.

Black guillemots nest either in loose colonies or as solitary pairs. Natural cavities in talus, on boulder beaches, or on rock cliffs provide suitable nest sites. On the Chukchi and Beaufort Sea coasts, guillemots nest on barrier islands composed of sand or gravel and largely devoid of vegetation and local relief. They inhabit piles of driftwood and various types of man-made debris, and their nesting range is probably limited by the presence or absence of such features. Their range may be expanding along with development of the Arctic.



L13"

Pigeon Guillemot

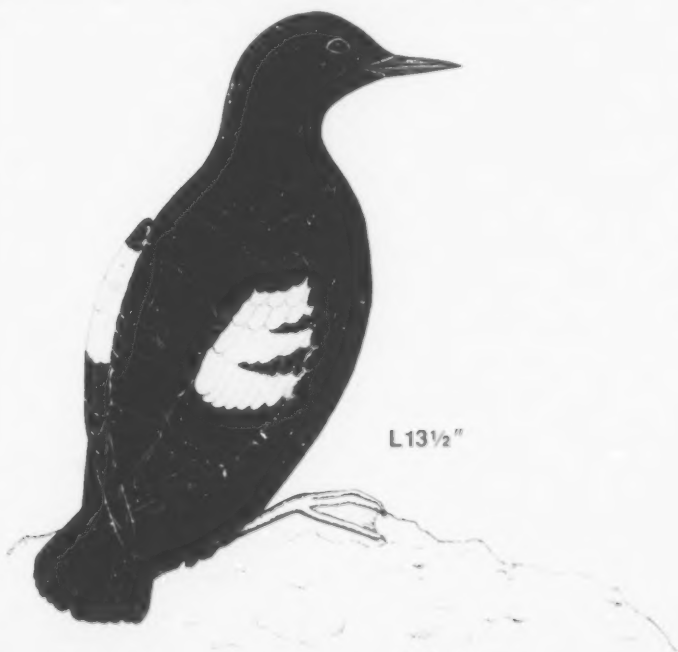


This species is common along the entire coastline of Alaska, but its frequency decreases as you get farther south or farther offshore. Look for pigeon guillemots along rocky shores, or take a tour from the Homer Spit out to their Gull Island nesting grounds. Listen while you watch. Their sustained, high-pitched whistle is distinctive and can be heard at quite a distance.

Like the black guillemot, it's all black except for white on the wings and red on the legs and inside the mouth. Pigeon guillemots have smaller white areas on the wings than do black guillemots, and a couple black crescents or wedges intrude into the white patches. If you don't get a good look, chances are you've seen a pigeon guillemot, unless you're on the Arctic coast. They are far more common than black guillemots.

You tend to see pigeon guillemots not in flocks, but rather one here, two there. They fly rapidly, close to the water, and they rarely stray more than a few miles from land. They dive for small fish, usually just outside the surf.

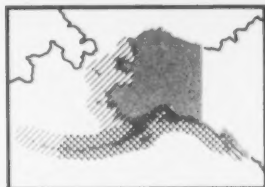
Where large numbers of guillemots occur, they usually form colonies. In many areas, however, breeding pairs are distributed ubiquitously, at low density, along rocky coastlines. They typically nest in natural cavities in boulder beaches, talus slopes, and broken cliffs at low elevations. They may also nest in unoccupied burrows of tufted puffins or, occasionally, dig their own burrows.



L 13½"

Murrelets

(Marbled and Kittlitz's)



These closely related birds share the distinction of being the least known of Alaskan seabirds, at least with respect to their activities on land. They are common in bays and fjords and are most abundant in inshore waters from southeastern Alaska to Kodiak Island. Kittlitz's murrelets are also common along the Alaskan Peninsula and throughout the Aleutians. Marbled and Kittlitz's murrelets are some of the most abundant birds in Prince William Sound.

Both species have dark brown backs, white patches where wings meet back, and white bellies, which you don't see when they're on the water. The white patches distinguish them from all other similar birds except least auklets. Even for experts, the distinction between Marbled and Kittlitz's murrelets requires close inspection.

Marbled murrelets are darker brown and darker all the way to the water line. The soft notes whistled between marbled murrelet pairs are distinctive and help in identification.

Kittlitz's murrelets have more golden backs and get lighter towards the water line. Their call is more of a deep squawk than a whistle.

Deep, fast wing beats and a rocking motion characterize murrelet flight. They tend to travel in pairs. Murrelets dive to feed primarily on small fish and crustaceans. Although they generally forage close to shore, the distance between feeding grounds and inland nest sites may be considerable.

Very few nests of either species have been found. Apparently neither species is colonial, and they visit land only at night. Marbled murrelet nests have been found as far as 20 miles inland, and Kittlitz's, 35 miles. Marbled murrelets have a unique nesting behavior for a seabird; they nest on the limbs of large old evergreen trees, except that in southwestern Alaska they also nest on the ground. Kittlitz's murrelets apparently nest in rocky, alpine habitat up to several thousand feet in elevation, as well as on steep sea slopes.



L9¾"



L9½"

Marbled Murrelet

Kittlitz's Murrelet

Ancient Murrelets



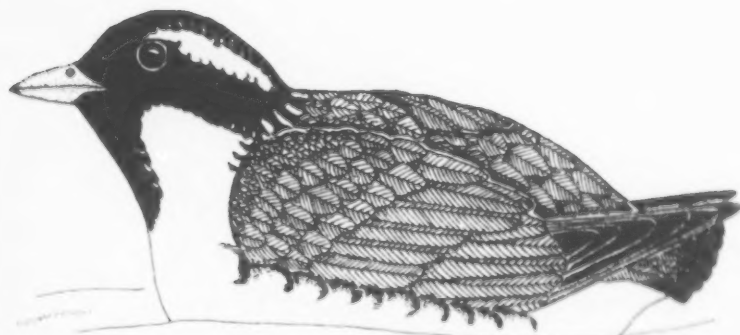
Ancient murrelets can be anywhere in the Gulf of Alaska, Bristol Bay or the Aleutians. They tend to spend their time offshore, over the continental shelf; however, they are sometimes seen from the ferry in Prince William Sound, in Resurrection Bay, or Kachemak Bay.

They have black caps and throats, gray backs, white underparts, a yellow bill, and a white stripe over the eye.

Except during the short breeding season, ancient murrelets generally live offshore. They travel in small bands, diving for small crustaceans and fish.

Ancient murrelets are nocturnal on their breeding grounds. They are colonial and nest in burrows up to about a yard long, or in natural cavities under rocks, tree roots, or overhanging clumps of sod.

They are exceptionally precocious. About two days after the chicks hatch, the adult birds call to them from the sea. Under cover of darkness, the downy chicks make their way alone to the adult birds waiting in the water. They complete their development at sea under the care of the adults.



L 10"

Cassin's Auklet

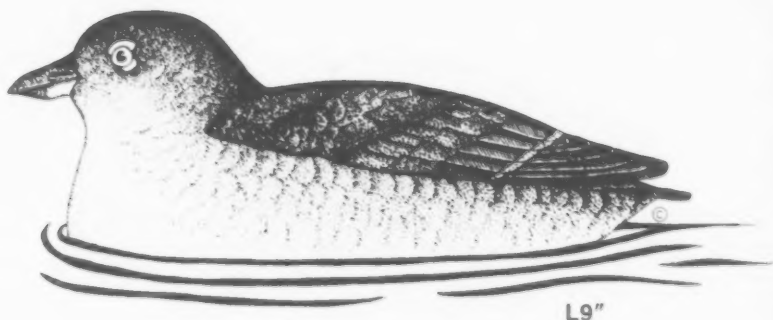


Cassin's auklets are abundant in southeast Alaska, and you're likely to see them from the ferry. They're found in shallow offshore waters of the Gulf of Alaska but tend to stay in eastern or western rather than central portions of the Gulf.

Cassin's auklets are little chubby birds that are dark above the water line and white below. Their dark bills are marked by a small white spot on the lower mandible.

They look quite round when they're in flight. They fly in a straight path, rapidly beating their short, stubby wings. The wings are a compromise in design that offers dubious efficiency above water, but also aids under water. They dive for planktonic crustaceans or other invertebrates, using their wings for propulsion.

Cassin's auklets are strictly nocturnal on their breeding grounds. Their nest sites are burrows. In southeastern Alaska they dig burrows under Sitka spruce or a heavy understory of salmonberry and grasses. Farther west, they occupy grassy slopes or areas of bare ground. Nesting densities are typically high, and in places this may lead to an absence of vegetation and consequent soil erosion.



Parakeet Auklet

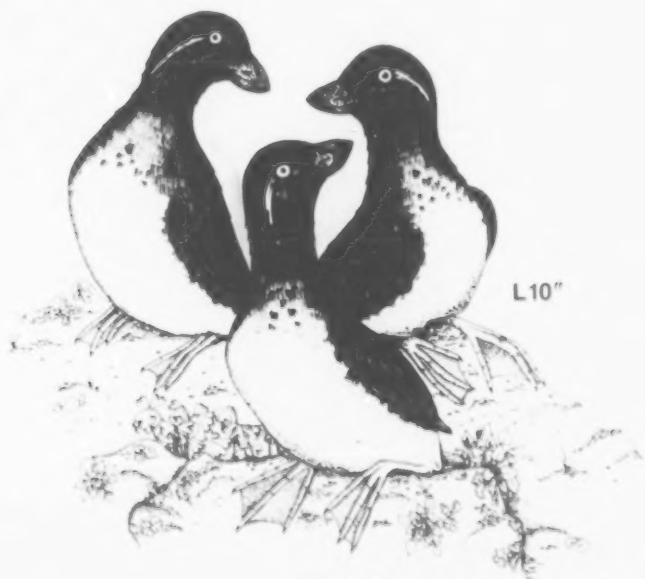


Although their center of abundance is the Bering Sea, parakeet auklets also breed on Chisik Island in Cook Inlet, around Prince William Sound and in the Barren Islands. They're more likely to be in shallow offshore waters than along the coast or in bays.

Parakeet auklets are plump birds. They have red, upturned bills, brown or gray heads and backs, white bellies, and single white plumes behind the eyes. They could be mistaken for rhinoceros auklets, but they're smaller than the rhinos.

Their flight pattern is usually rather direct, low over the water, and unfortunately, away. They scatter to feed on small crustaceans, which they obtain by diving. Like other auklets, murrelets and the puffins, they use their wings for propulsion underwater. After they finish feeding for the day, they group together on the water for a while before returning to the colonies.

Where their ranges overlap, parakeet auklets occur in mixed colonies with crested, least and whiskered auklets; however, the colonial tendency appears less strong in this species than in other auklets, and they often nest in small scattered groups or as solitary pairs. Parakeets nest deep within the rubble of talus slopes and in cracks and crevices on rocky shorelines or cliffs. Most of their nests are inaccessible to human observers as well as natural predators.



L10"

Crested Auklet



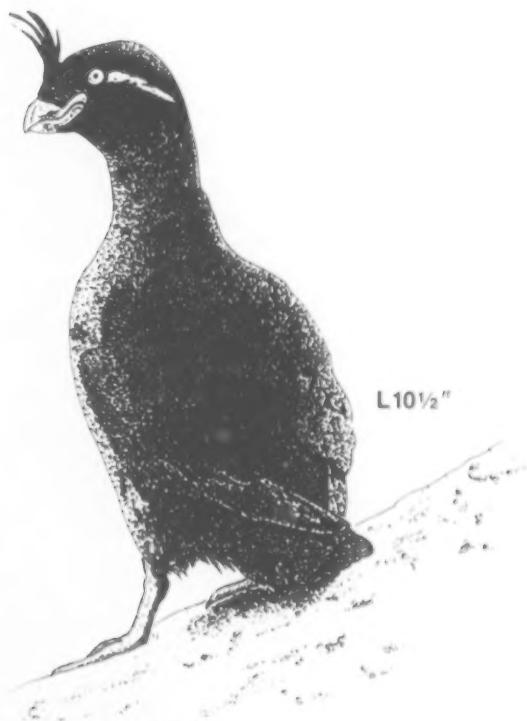
In summer crested auklets flock to the Bering Sea, and Aleutian and Shumagin Islands. Sometimes lesser numbers get as far east as Kodiak. In wintertime these birds are numerous in the bays around Kodiak.

They are slate gray, with bright orange bills and white plumes behind the eyes. Their crests are distinctive. Crested auklets also have a distinct odor. They smell like citrus fruit.

Flocking behavior is highly developed in crested auklets. Aerial displays by thousands of birds in dense, cloudlike flocks are unforgettable. In the summer of 1976 near Kodiak, a swarm of crested auklets, attracted to the night lights of a fishing boat, nearly sank the boat as crew members shovelled them off the decks. Like other auklets, they dive for small, planktonic crustaceans.

They frequently occur in mixed colonies with large numbers of least auklets and lesser numbers of parakeet auklets and whiskered auklets. Crested auklets nest in crevices in talus slopes, lava flows or cliffs.

Illustration by Anthony R. DeGange



Least Auklet



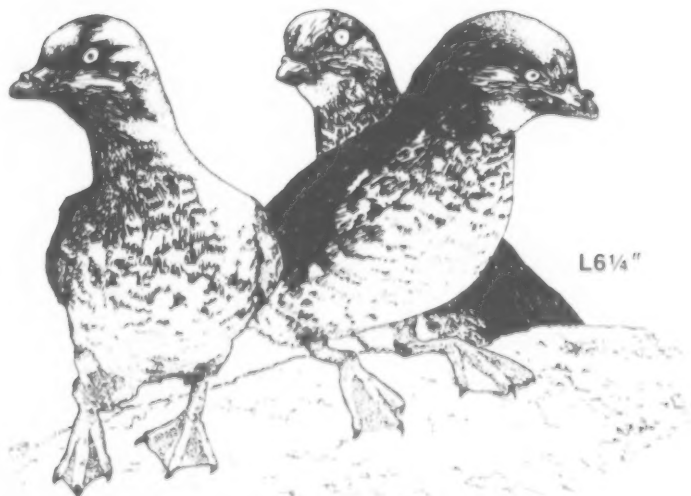
Least auklets are among the most abundant seabirds in Alaska, but their remote range makes them inaccessible to most bird watchers. In summer they stay close to their breeding colonies, which are mostly islands in the Bering Sea and the Aleutians. During migration, however, least auklets are sometimes sighted in the western Gulf of Alaska and even in Cook Inlet and Prince William Sound.

Least auklets, suiting their name, are the tiniest auklets. They are black on the upper parts except for white patches on the scapulars and white streaks on the forehead and face. The chin is black. The remaining under parts are white mottled with dusky.

Least auklets usually cluster in small groups of five or ten birds. Their flight, with rapid wingbeats in erratic patterns, has been likened to that of bumblebees. It's hard to get a look at them as they flush well ahead of ships. They feed, by diving, on planktonic crustaceans, primarily in nearshore water.

Least auklets commonly nest in enormous colonies in close association with other auklets. The largest colonies contain from 250,000 to a million birds, and the numbers of least auklets greatly exceed the others in most mixed colonies. Least auklets lay single eggs in bare rock crevices deep in talus or in small cavities in lava flows overgrown with vegetation.

Illustration by Arthur Sova



Whiskered Auklet



The worldwide distribution of whiskered auklets is very limited. There are only a few islands in the Aleutians where you might find them. A highly motivated bird watcher might fly to Dutch Harbor, obtain a boat and head into Avatanak Strait. Around Basalt Rock, in early afternoon, the prized whiskered auklet is likely to appear . . . and he's likely to appear surprised.

Whiskered auklets are small birds with slate gray backs, white underparts and bright orange bills. They have carried head plumes to the extreme. Each bird has seven: a black plume protruding from the forehead and three white plumes on each side of the face. In flight a whiskered auklet may be mistaken for a least auklet, but only one has head plumes.

They travel in small flocks. They change directions suddenly, land suddenly, scatter suddenly, and dive suddenly. Little study of their feeding habits has been carried out. Other auklets in their range eat planktonic crustaceans, and whiskered auklets probably have similar food habits.

They commonly nest in talus, in company with least and crested auklets. The apparent decline or disappearance of whiskered auklets from the most westerly islands of the Aleutian chain casts doubt on their status farther west; but, at least historically, they breed in the Kurile and Commander Islands as well as throughout the Aleutians. The largest known colony today is on Buldir Island.



Rhinoceros Auklet



Rhinoceros auklets breed in small numbers throughout the Gulf of Alaska. They are most commonly seen in the Gulf's deeper waters, but occasionally a bird or pair will visit the outer portions of some of the bays. For instance, they have been sighted in Resurrection and Chiniak Bays.

They appear all dark when sitting on the water but show their white bellies in the air. Unusual head adornment includes not only white plumes but also a small yellow horn at the base of the yellow bill. They look a lot like a thin-billed version of a puffin.

With wings that are almost too small for their bodies, their flight is labored; takeoffs comical. Remember, the wings also function underwater! Rhinoceros auklets feed on small fish and crustaceans, using their wings to swim to considerable depths. After feeding they gather offshore for a while before turning in for the night.

They excavate burrows on grassy slopes or beneath forest canopies. Birds enter and leave colonies only at night, making detection of their colonies difficult.



Horned Puffin



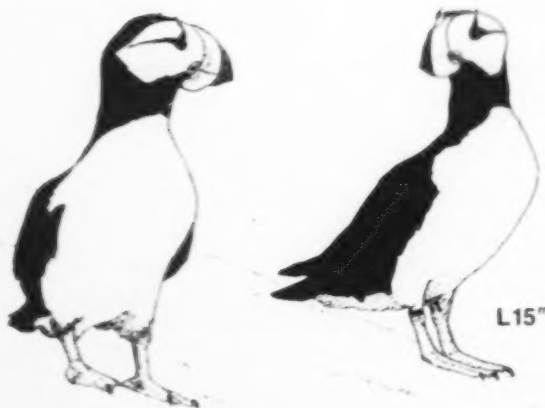
Horned puffins are found in bays or just off rocky headlands, riding swells in groups of two to ten. Their center of abundance in Alaska is off the southern coast of the Alaska Peninsula, somewhat west of Kodiak; however, they breed around Kodiak Island in large numbers, along Prince William Sound, in the Chriswell Islands near Seward and in lesser numbers in Cook Inlet. Boat tours out of Seward are one of the most convenient ways to visit puffin colonies.

Horned puffins have huge bright yellow bills with red on the tip. They have a small dark horn made of skin above each eye. Underparts are white except for a black collar. Feet are bright orange.

Puffins possess heavy wing loads. They flap vigorously to go short distances, but are capable of flying a long distance. They use wing propulsion to dive, mostly for small fish but also for cephalopods and crustaceans.

Horned puffins generally nest under beach boulders, in talus, or in crevices of cliffs.

Illustration by Arthur Sclafani



Tufted Puffin



Of all seabirds in Alaska, this is the one most likely to be seen. Tufted puffins are abundant and can be in marine waters anywhere: near shore, offshore, in bays.

They have bright orange bill plates and orange-red feet. Their faces are white. The tufts are yellow. The rest is black.

They fly by flapping vigorously. Their diet is composed of small fish, cephalopods and crustaceans captured by diving. The wings are used for propulsion underwater. The large bill accommodates them in the chase. Small projections and grooves on the roof of the mouth and tongue help retain the first caught fish while the puffin continues to chase others.

Tufted puffins nests in burrows or, rarely, in rock crevices. Burrows often reach two meters in length and may have two or more entrances. In a typical colony, these puffins burrow on steep slopes or in soil along the tops of cliffs. Because tufted and horned puffins differ in their nest preference, the two species avoid competition for nest sites, allowing almost complete overlap in breeding distributions of the two species.



L15"

Field Notes

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